THE

# MECHANICS' MAGAZINE,

## MUSEUM,

## Register, Journal,

AND

## GAZETTE,

JULY 3rd, 1841—DECEMBER 25th, 1841.

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## VOL. XXXV.

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"All science arises from observations on practice. Practice has always gone before method and rule; but method and rule have afterwards improved and perfected practice in every art."

BLAIR.

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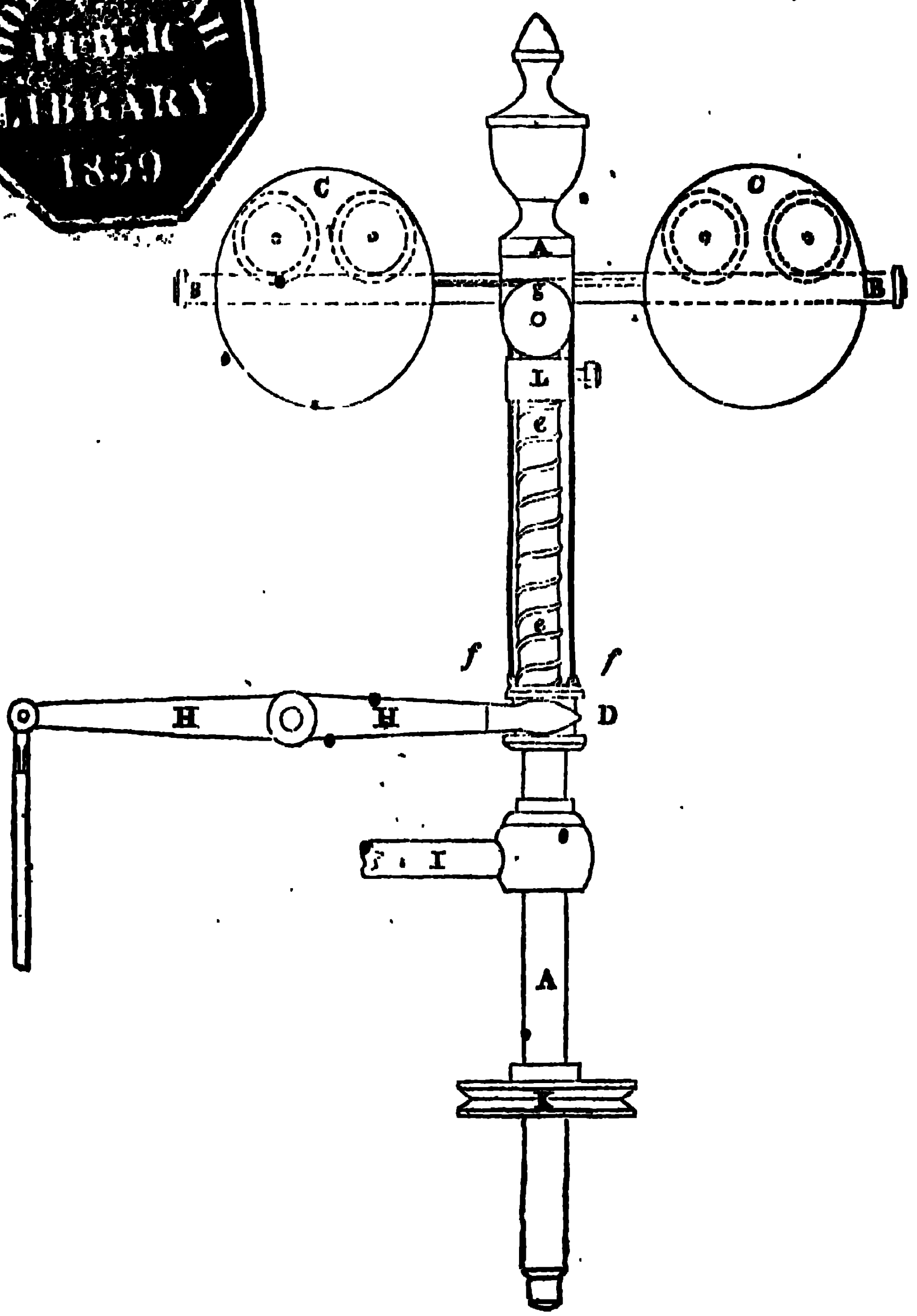
G Gilbert

## DAVIES'S IMPROVED GOVERNOR.



## DAVIES'S IMPROVED GOVERNOR.

(Registered pursuant to Act of Parliament.)

In the well known Pendulum Governor of Watt, the centrifugal force operates to counteract an increased speed of the machinery with which it is connected, by overcoming the force of gravity.

Ingenious as this contrivance undoubtedly was, and to a certain extent efficacious, yet it had not been employed long before it was found to possess inherent defects, and that its action produced a constantly varying, rather than a regular motion. The cause of this is mainly attributable to its extreme sensibility and delicacy of action, by which an excess of motion in either direction continually occurs, producing a series of variations in the speed of the engine, which scarcely ever settles down to a regular rate of motion, unless the production of steam and the work performed, are of themselves constantly uniform.

In consequence of these defects, numerous attempts have been made to improve the governor; two recent patents for this object were duly noticed in our pages, and we gave at considerable length in our last volume (p. 370) the ingenious contrivance of Mr. Hick, in which the atmospheric resistance to rapid motion, is employed instead of the centrifugal force, to overcome the force of gravity.

By the arrangements which Mr. Hick has adopted, gravity, although still a constant force, was capable of being controlled by the quantity of opposing surface brought into action, so that by varying the angle of the fans or vanes, a capability of adjustment was afforded, not readily attainable in the original form of apparatus.

In the governor which we have this week the pleasure of laying before our readers, this capability of adjustment is still further increased, as the resistance to centrifugal energy (which is in this case a spring) can be increased or diminished to any required extent.

This simple and ingenious piece of apparatus is the invention of Mr. Henry Davies, the inventor and patentee of the Disc steam-engine, now attaining considerable celebrity, and to which we shall probably hereafter have occasion to call the attention of our readers.

By reference to the engraving on our front page the construction and operation of this governor will be easily understood. It consists of an upright spindle AA, near the top of which are two equal horizontal arms, BB, furnished with stops at their extremities. Two weights CC run freely to and fro upon these arms by means of internal anti-friction wheels. D is a collar sliding upon the spindle suspended by two cords or chains, *ff*, which pass over two pullies (one seen at *g*) and are attached to the weights CC. A spiral spring, *e*, rests at bottom upon the collar D, and abuts at top against a sliding stop, L, which can be fixed at any required elevation upon the spindle by a set screw. H is the throttle valve lever with its forked end embracing the groove in the collar, D. I is a supporting arm, and K a pulley for receiving motion from the crank shaft of the engine.

The stop L having been set so as to cause the spring to press down the collar D, with any approved force, and the throttle valve opened to the required extent, the engine may be started. Should its speed exceed the stipulated rate, the increased centrifugal force will cause the two weights to recede from the spindle, which raising the collar, D, will partially close the throttle-valve and diminish the supply of steam, when, the motion being checked, the spring will press down the collar, and withdraw the weights until the desired rate of motion is obtained.

The degree of force exerted by the spring will of course always require to be adjusted to suit the nature of the work thrown upon the engine, because a small quantity of steam will be required when the work is light, and a larger quantity when it is heavy, while the speed should in each case be the same, a position which this kind of governor can be made to realise with great facility and remarkable precision.

In point of simplicity of construction and cheapness, as well as in the perfection of its action, this governor seems to have a decided advantage over all former contrivances for the same purpose, and we have no doubt will soon come into very extensive use.

## DRY ROT—ITS CAUSES AND PREVENTION.

Sir,—The phenomenon of what is called "dry rot" in timbers has been often lamented, but almost invariably misunderstood. Certain harmless plants, such as the *merulius destructor*, and *merulius lacrymans*, (so called from the quantity of liquid which replenishes the *hymenium*,) the latter a misnomer when connected with the *dry* rot. These plants are held up to public execration as the delinquents, and as chargeable with the work of destruction. They stand, however, fully acquitted in the eye of science, as the deed is already done before they make their appearance, even in embryo, though their rudiments, in *seeds*, are already there. Like "the worm of corruption," they riot on decay,—it is the matrix wherein they germinate; but the disintegration of the organized structure has been already consummated.

It is assumed by Mr. Kyan that the *cause* of dry rot is to be sought for in the decomposition of the *albumen* of the sap; and the chloride of mercury, by combining with this albumen, and thus forming a substance undecomposable by the usual agencies of decay, constitutes the principle of *his* patent. Doubtless albumen may be arrested in its tendency to decay by chloride of mercury, or corrosive sublimate. It is, however, sheer assumption to say that dry rot has to do with the albumen of the sap. Sir W. Burnet, in his counter patent, I believe employs a salt of zinc.

The great expense of mercury, the price of which is considerably enhanced by the monopoly of Rothschild, forms a serious obstacle to Kyan's plan, and the price of the shares of the Patent Anti Dry Rot Company shows that great success does not follow their enterprise. Knowing that Sir H. Davy had selected chloride of mercury for a similar purpose, but very properly abandoned it from a conviction that it would form a deleterious and destructive atmosphere of mercurial vapour, I ventured to oppose it on the same grounds, contending, that in tropical climes, it would be as poisonous as the quicksilver mines of Idria, in Illyria, independent of its ready decomposition by the contact of iron and alkalis. As a matter of course, Mr. Kyan was quite furious, and summoned to his aid Dr. Birkbeck, who attacked my position through the medium of the *Morning Post*. It turns out, however, that I was correct. There is, unhappily for the cause of truth, and advance of genuine knowledge, much favouritism in relation to the authority of a name, and *party spirit* runs as high in the coteries of science, as in the region of politics. Sir John Barrow, in his life of Lord Anson, has entirely impugned the efficacy of Kyan's process. The Duke of Portland had done the same thing in 1838, and to the same effect are the conclusions of Earl Manvers. Dr. Moore, in like manner, in his experiments at Plymouth, had shown that "Kyanised wood," as it has been called, is no proof against the ravages of the *teredo navalis* or shipworm, which was honey-combed like the rest.

The experiments made at Welbeck in the mushroom house are very instructive and important, and appear to be entirely conclusive. Good Baltic timber in these trials, lasted longer than the best "Kyanised" oak. "Kyanised" and unkyanised oak decayed equally fast. It appears, too, that wood impregnated with Sir William Burnet's solution, and that which was not so treated, decayed alike. On the other hand it was proved that Scotch fir deals, and copperas, (*i. e.* sulphate of iron,) with lime water, resisted decay longer than any of them. It may be added that I had proved experimentally that sulphate of copper, also chloride of copper, would coagulate albumen, and therefore that this property did not exclusively pertain to corrosive sublimate, consequently that either of these might be substituted for it.

I may add, in this place, that Dr. Boucherie proposes to impregnate the tree, either by the root or by the bole, with a solution of impure pyrolignate of iron, prior to its being cut down. These two salts of iron are identical in their operation on the sap of the tree, and mutually illustrate the action of each other.

Fifteen years have elapsed since I communicated to the Admiralty, through Sir John Barrow the secretary, as a prophylactic, or preventive of "dry rot," the very agent, namely sulphate of iron, &c., which has thus been proved

so successful, and to triumph over all others, even *patent* plans and projects.

Yours, &c.

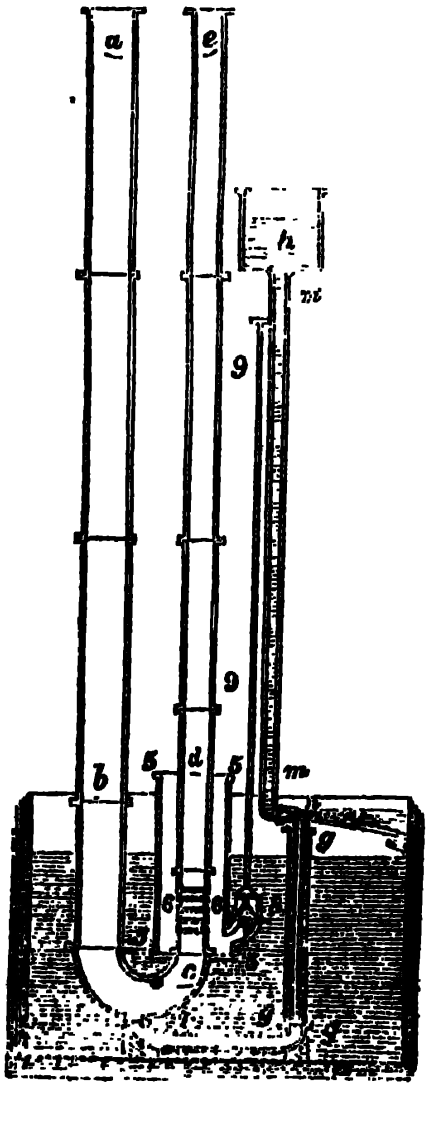
J. MURRAY.

June.

## ADCOCK'S PATENT SPRAY PUMP.

The following extract from a communication by Mr. Adcock, which appeared in the last number of the *Mining Journal*, fully illustrates the construction and action of his patent Spray Pump, of which we inserted a descriptive notice in a recent number.

"This wood-cut is intended to represent and explain a plan put down by me at the 100-yard shaft, at Pemberton, to relieve the bend pipe and lower part of the apparatus from any water that might, from accidental or other cause, be there collected; and as it answers the intended purpose well, I have no doubt the wood-cut, and its descriptive account, will be gratifying to many of your readers.




"In the wood-cut *a b c* represents a part of the downcast pipe, or the pipe that conveys the air from the top of the pit, or the galleries and workings of the mine, through the bend pipe into the upcast; *b* to *c* the bend pipe, or that which unites at the bottom of the pit the downcast with the upcast; *c d e* the upcast pipe, or pipe through which the air, and the water commingled with it, is carried to the surface or top of the pit, that the water may be there again collected in a solid body, and thence be allowed to flow freely away; 6 6 represent five slits, through which the water flows from the sump or well at the bottom of the pit into the upcast pipe, when the apparatus is in action, that it may, by the current of air, be dispersed into drops, like drops of rain, and conveyed to the top. The downcast pipe is 29½ inches diameter—the upcast pipe 17½ inches; and when not working, and from causes which it is not necessary to explain, water leaks from the sump into the apparatus, to a height equal to the head of the water there, which is about eight feet from the bottom of the bend, or 8 ft. 7 in. from the bottom of the pipe beneath the bend, consequently, the water rises to the same height in the pipe *g g g g*, which is four inches diameter; *m m* is a pipe, twenty feet long, that receives a supply of water from a water ring, placed so as to receive the water that oozes through and trickles down the sides of the pit. This pipe also is four inches diameter, but is unnecessarily large; it terminates in a compound cone, marked *n*, as shown in the figure. Of the smaller cone the dimensions may be thus stated:—Its greater diameter, $\frac{88}{100}$th of an inch; its smaller diameter, $\frac{8}{10}$th ditto; and its length [illegible] Of the greater cone [illegible] dime[illegible] may be thus stated:—[illegible] smaller diameter, $\frac{6}{10}$th of an inch; its greater diameter, $1\frac{1}{12}$th ditto; and its length, $5\frac{4}{10}$th ditto. A pipe, $\frac{6}{10}$th of an inch diameter, descends from the junction of the larger cone with the smaller into the four-inch pipe, *g g g g*, as shown by the wood-cut. This pipe is nine feet long.

"Having thus given the proportions, I have only to describe the *rationale* of the contrivance:—The water in the pipe, *m m*, is maintained by the water ring, or by the water that oozes through and trickles down the sides of the pit to

a height or level, equal to the height of the pipe itself, or twenty feet. Now, it is well known that the theoretic velocity of water, flowing out of an aperture, is equal to that of a heavy body falling from the height of the head of water, which is found, very nearly, by multiplying the square root of that height in feet by 8, for the number of feet described in a second. Thus, a head of 1 foot gives 8, a head of 9 feet 24, and a head of 20 feet 35¾ feet per second. This is the theoretical velocity; and from what is equally well known respecting the *vena contracta*, or the contraction which all streams undergo when passing through orifices, we must, in order to obtain the actual velocity, multiply the square root of the height, in feet, by 5 instead of 8. It is equally well known, from the experiments of Venturi, Bryan Donkin, and others, that when water flows through a compound cone, as exhibited in the wood-cut, the quantity discharged, and, consequently, its velocity, is even greater than that due to the theoretic velocity. But as the twenty-feet pipe, under consideration, terminates in an elbow, just before its junction with the double cone, I am quite willing, in order to prevent dispute, to consider the velocity of the water through the double cone as that due to the contraction of the stream. Hence $\sqrt{20} \times 5 = 22\frac{1}{4}$ feet per second, instead of 35¾ feet, as above stated.

I have already had occasion to remark, that the diameter of the suction pipe, nine feet long, which passes from the lower part of the double cone into the pipe, *g g g g*, is $\frac{6}{10}$th of an inch; hence, the diameter of that pipe being [illegible] an inch and the velocity of the water flowing [illegible] it, at its junction with the cone, twenty-two feet per second, the time occupied, or taken up, by any given particle flowing over its diameter, is $\frac{1}{440}$th part of a second—equal, decimally, to ·00227 of a second.

"Now, by the laws of gravitation, the space through which a body will fall in a given time, in feet, is as the square of the time, in seconds, multiplied by $16\frac{1}{12}$. Hence, $·00227^2 \times 16\frac{1}{12} \times 12$ in. = ·0001, very nearly, or about a thousandth part of an inch. Hence, by the laws of gravitation, and considering, at the same time, the expansion of the outward cone, from $\frac{6}{10}$ to $1\frac{1}{10}$ inch diameter, and that, too, in a length of $5\frac{4}{10}$th inches, there is not time, in the passage of the water over the orifice of the $\frac{6}{10}$th inch pipe, for any portion of it to fall into that pipe; hence, as the water flows over the orifice of that pipe with rapidity, it, by its friction or adhesion, or the lateral communication of motion in fluids, withdraws from it some portion of the air, and, subsequently, of the water, so as to produce a partial vacuum. The weight of the atmosphere, in the downcast and upcast pipes of the patented apparatus, then comes into play, and forces the water in those pipes continuously from the pipe, *g g g g*, up the $\frac{6}{10}$th inch pipe, and then through the larger cone, until the surface of the water in the bend pipe, *b* to *c*, gets below the level of the nine feet pipe, and, consequently, is below the bottom of the bend. Thus, Mr. Editor, without valves, clacks, pumps, or any thing that can get out of order, is this important object effected.

I am, Sir, yours, &c.,
HENRY ADCOCK,
Civil Engineer.

June 21, 1841.

## A SINGULAR RAILWAY PHENOMENON.

Sir,—Can you or any of your numerous correspondents account for the singular circumstance of carriage wheels being firmly fixed on their axles after having travelled on a railway truck in one of the trains? I witnessed a circumstance of this kind the other day, and I have been told that it frequently occurs. If the cause can be discovered, some means may be found out to prevent it. If any light can be given on the subject it will be conferring a great benefit.

Yours, and
A SUBSCRIBER
From the Commencement.

N.B. I should say that it is to the patent axles that this happens.

[The occurrence is not only frequent, but constant, and arises from oscillation. It is easily, and we believe only remedied, by supporting the carriage on blocks, &c., and leaving the wheels free. Mr. Davies, the celebrated coach manufacturer, of Wigmore-street, who had experienced considerable annoyance

from this circumstance, made numerous railway trips in order to detect the cause, and to find a remedy for the evil. —Ed. M. M.]

### WHITELAW AND STIRRATT'S PATENT WATER MILL.

(From the *Paisley Advertiser*, June 26.)

Since the invention, a few years ago, of this admirable method of using water power, we have had frequent occasions of directing public attention to its merits. On Wednesday last, one of them was set a-going in Stirlingshire, and as it is of much greater power, being 95 horse, than any heretofore erected, we shall give a few particulars relating to it, to show that the fears entertained by many of its efficiency on a large scale, have proved groundless. The works at which the mill we now allude to is erected, are those of the Culcreuch Spinning Company, Stirlingshire. The building is 6 stories high, nearly 200 feet long, and 38 feet wide; and it contains above 20,000 mule spindles, several hundred throstle spindles, with the other machinery necessary in such a work. The fall which supplies it with water is 37 feet, and the quantity of water is 1,800 feet per minute. Heretofore two overshot water-wheels have been employed; one old one of 32 feet diameter, by 12 feet wide, taking 1,200 feet of water per minute, the other nearly a new one, 33 feet in diameter, and 5 feet wide, requiring 600 feet per minute. The united power of the two wheels was supposed about 60 horse, and they were barely sufficient to drive the machinery. In place of these two wheels one of Whitelaw and Stirratt's Patent Water Mills has been substituted, and, as we have mentioned, it was set in motion on Wednesday night. From some accidental flaw in one of the castings, which could not be foreseen, the point of one of the arms was, by the centrifugal force, thrown off. This, of course, did not admit of immediate repair; but as the work-people had been summoned to their labour for next day, it was necessary to provide a temporary expedient. This was done by removing the broken piece at the joint, and screwing a stout piece of wood over the orifice. Of course this was reducing the power of the mill one half, but it was thought better to drive as much of the machinery as possible, and employ part of the hands, rather than let the whole remain idle. On Thursday morning the water was admitted to the mill, thus deprived of the use of one of its two arms, when, to the delight of all, it drove freely the whole of the machinery. The mills, noticed by us from time to time heretofore, were generally of a small size, varying from 5 to 18 horse power, except one of 59 erected in Greenock. When describing the latter, we noticed that its powers were ascertained by friction apparatus, but as the nature of this is little known, except to scientific men, it would be a more satisfactory test to see the mill do the real work for which it is erected; and this test was fully supplied at Culcreuch. Trials have now been made of these mills from $1\frac{1}{2}$ up to 95 horse power, and their great superiority over the ordinary water-wheels, has, within that range, been fully tested. Their great superiority in point of compactness over the ordinary wheel is so apparent, that we need not dwell on that point. With respect to economy, the advantages are as great as they are in other respects. The expense of erecting a water-wheel at the Culcreuch works, of sufficient magnitude to make the whole power of the fall available, would, with its arc, have cost at least 2000*l.*, while the expense of the patent mill, including the pipes for conveying the water to it, will not exceed £600. The additional power possessed by these mills seems to many a matter of mystery. We do not profess to describe the cause fully, but there is one circumstance which in itself affords a pretty full explanation. The water-wheels at Culcreuch made only about four revolutions per minute, consequently the intervention of a great quantity of gearing was necessary to bring up the speed. This, of course, consumed much of the effective power, but this drawback is got quit of by the speed of the patent mill itself, which makes sixty revolutions a minute, while it is so accurately balanced, as to diminish friction to the smallest possible extent, leaving the whole power of the water to be advantageously employed in driving the machinery. A farther improvement has been made on the mill since we last noticed it, but this we have not left ourselves room to describe. We shall let it suffice to state that the object of it is to overcome the disadvantages which mills are subjected to by back-water in the mill-race. There can, we think, be little doubt that as water-wheels wear out, these mills will be substituted, till they become general, and to this they are, from their simplicity, compactness, power, and economy, fully entitled. The demands for them are already so great, that the patentees have been unable to answer them, and to prevent disappointment they have resolved to grant, in the three kingdoms, licences to the extent of twenty-five. Some of these have already been taken out in this neighbourhood by the principal engineers in that line. Of course the public will now have various sources of supply.

## CASE OF JAMES MAXWELL, THE STEAM-BOAT PILOT.

It is hoped that no apology will be required for bringing before the public the following case of extreme distress, connected as it is with circumstances which must be interesting to every generous and humane individual under whose notice this may come:—

In the 171st number of *Chambers' Edinburgh Journal* there is a narrative, detailing an instance of one of the most miraculous preservations of human life, from destruction on board ship, that has almost ever occurred. It is under the title of "A Hero in Humble Life," and exhibits the self-denial and bravery of one James Maxwell, (under the fictitious name of Cochrane,) a pilot, who, in the year 1827, was the individual means of saving the lives, to the number of betwixt seventy and eighty, of the passengers and crew of the Clydesdale Steam-packet. This vessel was destroyed by fire on her voyage betwixt Glasgow and Belfast, and the preservation of those on board of her, by the pilot, is thus abridged from the article in *Chambers' Journal* alluded to:—"On its being ascertained that the only way to save those on board was to run the vessel ashore, the pilot instantly took the helm, and fixed himself to the spot. The fire, which the exertions of all the men could not keep under, soon raged with ungovernable fury, and, keeping the engine in violent action, the vessel, one of the fleetest that had ever been built, flew through the water with incredible speed. All the passengers were gathered to the bow, the rapid flight of the vessel keeping that part clear of the flames, while it carried the fire, flames, and smoke backward to the quarter-deck, where the pilot stood like a martyr at the stake. Every thing possible was done by the master and crew to keep the place on which he stood deluged with water, but this became every moment more difficult and hopeless, for, in spite of all that could be done, the flames seized the cabin under him, and his feet were literally roasted on the deck. Still he never flinched, for, had he done so, all might have perished. At intervals, the motion of the wind threw aside the intervening mass of flame and smoke for a moment, and then might be heard exclamations of hope and gratitude, as the multitude on the bow got a glimpse of the brave man, standing calm and fixed on his dreadful watch. By this time the vessel was within a stone-cast of the Galloway coast, girded as it is with perpendicular masses of rock, but every corner of which the pilot was acquainted with, and this enabled him to run her into an open space, and alongside a ledge of rock, upon which every person got safe on shore, all unscathed, except the self-devoted one, to whom they owed their lives."

The foregoing particulars have been all ascertained to be true. Poor Maxwell, however, was so injured, and his constitution so shattered, by his exertions and sufferings on that awful occasion, that he has never been the same man since. For several years subsequent to this occurrence, he was employed as a pilot by one of the most respectable Steam Companies on the Clyde, but for a long time he has not been able to do a hand's turn. He is now completely bed-ridden, (in fact, in a dying state,) and labouring under severe rheumatism of the breast and legs, from the effects of the fire. He has a wife and six children, the eldest only fourteen years of age, and all are completely destitute.

As it is supposed that many humane persons would feel pleasure in extending their charity towards this deserving individual, if assured that it would be applied properly, the following gentlemen, who have inquired into, and are conversant with, the circumstances of the case, have formed themselves into a Committee, for the purpose of receiving contributions, and properly applying the same, namely,

Mr. Robert Napier, Engineer, Glasgow.

Messrs. Thomson and Macconnell, Steam Packet Agents, Glasgow.

Messrs. William and Robert Chambers, Conductors of the Journal, Edinburgh.

Mr. R. W. Hamilton, General Steam Packet Company's Office, Edinburgh, and,

Mr. George Mills, Shipbuilder, Bowling Bay, Glasgow, Secretary for the Subscription.

The facility afforded to the community by the penny post in forwarding subscriptions to any of the above-named individuals is respectfully suggested; and it is hoped that those who may be only able to afford small sums, will induce others to join them in making up an amount easily remittable. It is likewise hoped that editors of newspapers will give insertion to this notice as an act of charity, if suitable with their arrangements.

## REMOVAL OF SUNDERLAND LIGHTHOUSE.

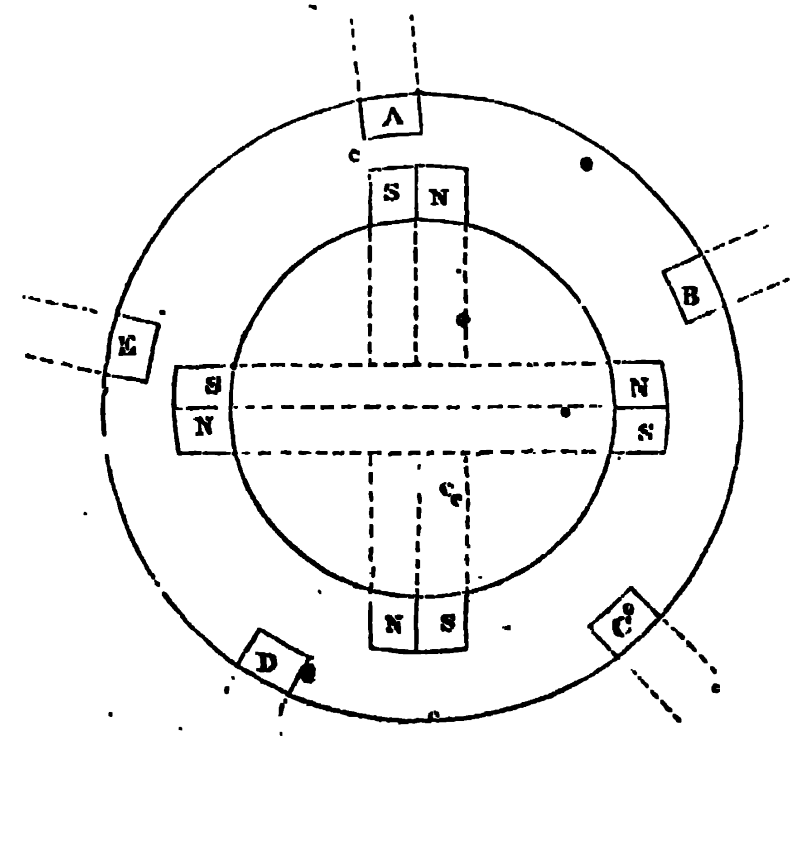
At a late meeting of the commissioners of the river Wear, the taking down of the lighthouse being discussed, as part of the plan of building the new north pier at the mouth of the harbour, Mr. Murray, the engineer, suggested the removal of the lighthouse, in its present entire state, to the eastern extremity of the new pier, a distance of about 420 feet, so as to make it serve the double purpose of a stationary and a tide light. Mr. Murray exhibited a model of the building, and after explaining how he proposed to effect this undertaking, the board decided that he should proceed forthwith to remove it. This light-

house was erected about forty years ago, b the late Mr. Pickernell, then engineer to th harbour commissioners. It is wholly composed of stone, its form is octagonal, fifteen feet in breadth across its base, sixty-two feet in height from the surface of the pier to the top of the cornice, where it is nine feet in breadth across, and the top of the dome is sixteen feet above the cornice, making a total height of seventy-eight feet, and its calculated weight is 250 tons. Mr. Murray intends to cut through the masonry near its foundation, and insert whole timbers, one after another, through the building, and extended seven feet beyond it. Above and at right angles to them, another tier of timbers is to be inserted in like manner, so as to make the cradle or base a square of 29 feet; and this cradle is to be supported upon bearers, with about 250 wheels of 6 inches diameter, intended to traverse on six lines of railway to be laid on the new pier for that purpose. The shaft of the light-house is to be tied together with bands, and its eight sides are to be supported with timber braces from the cradle upwards to the cornice. The cradle is to be drawn and pushed forward by powerful screws, along the railways above mentioned, on the principle of Morton's patent slip for the repairing of vessels. However surprising the removal of such a building may appear to many, yet in New York, for some years past, large houses have been removed from their original situation to a considerable distance, without sustaining any injury. The immense block of granite, serving as the pedestal of the equestrian statue of Peter the Great, at St. Petersburgh, was conveyed four miles by land, and thirteen by water. Several obelisks have likewise been transported, at different times, from Egypt to Europe; and lately, one was conveyed from Thebes, and erected by the French at Paris. But the fact that the light-house on our north pier is composed of stones of comparatively small dimension, its great height, and small base, make the operation of removing it much more difficult than any thing of the sort ever attempted. We heartily wish the enterprising engineer every success in his bold and novel undertaking, which is to be carried into execution in the course of a few weeks.—*Sunderland Herald.*

## PERPETUAL MOTION BY MAGNETISM.

Sir,—In spite of my ignorance, I have always thought that perpetual motion could never be obtained by means of complicated mechanism, or by using water as the thing to be moved and as the cause of motion; because in every case the friction of the component parts of the machine, or even the resistance of the atmospheric air, would be an insurmountable obstacle; but I have long entertained the idea that the magnetic power might be applied in such a manner as to cause a wheel to revolve perpetually.

Fig. .

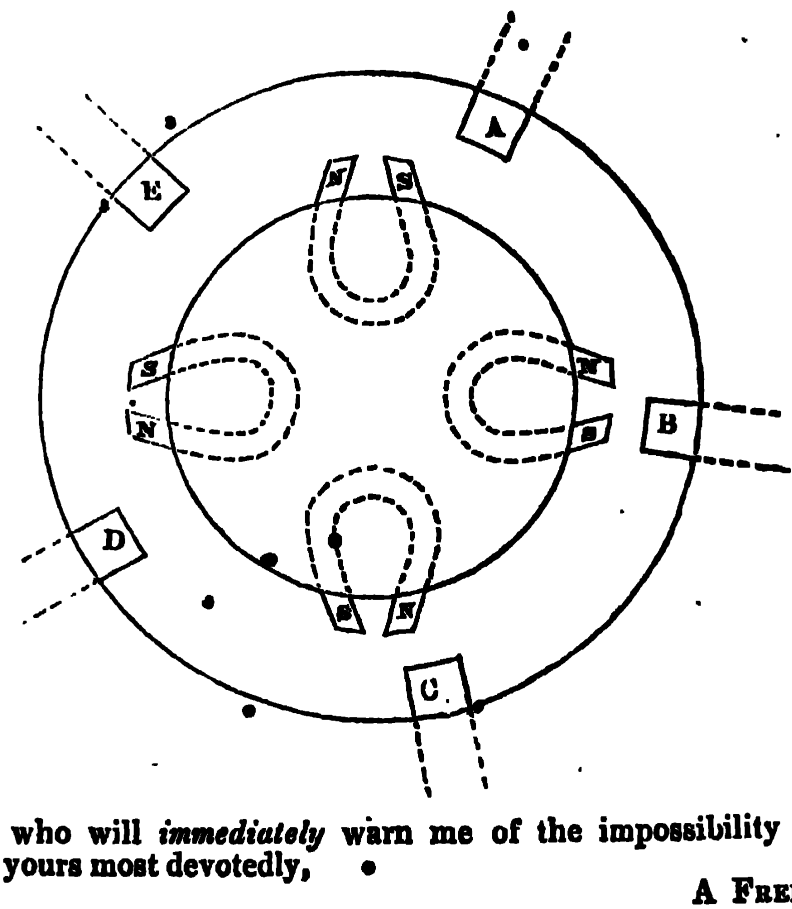


My first plan is this: two magnetic bars are laid side by side with their dissimilar poles against each other. Two other bars of the same description are placed at right angles on the middle of the former. This makes four successive rows of magnetic bars, each row possessing a northern and a southern polarity. These bars are inclosed in a wooden wheel, the centre of which, I shall suppose, rests upon a finely-pointed pivot. In order to make this wheel revolve, I take five powerful magnets strongly secured, so as to prevent any motion in them, and of which the five north poles, A, B, C, D, E, (which are alone required,) are placed as shown in fig. 1.

Now it will be seen, that in every position of the wheel containing the smaller magnets, the attraction of the large north poles for the south poles of the small magnets, and repulsion of the large north poles for the north poles of the small magnets will combine, to give to the wheel a rotatory motion.

I am but slightly acquainted with the science of magnetism, (this is perhaps the cause of the delusive idea under which I am now working,) but I think that in case two magnetic bars laid side by side should not exhibit sufficient energy, four horse-shoe magnets, placed as in the annexd drawing, fig. 2, could be used with the same, or perhaps a greater advantage.

Fig. 2.




Any one who will *immediately* warn me of the impossibility of my plans will oblige, yours most devotedly,

A FRENCHMAN.

April 5, 1841.

## ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

**** *Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for the purpose.*

ELIAS ROBISON HANDCOCK OF BIRMINGHAM, ESQ., *for certain improvements in mechanism applicable to turn-tables for changing the positions of carriages upon railroads, which improvements are also applicable to castors for furniture and other purposes.*—Enrolment Office, June 18, 1841.

These improvements comprise first, the application of anti-friction collars to vertical and horizontal axles; secondly, an improved

method of retaining the oil which is to lubricate the same; and thirdly, in arranging and supporting vertical axles or pivots, so as to sustain heavy weights thereon. They are shown as applied to turn-tables, castors, and the axles of carriages, but are applicable to many other purposes.

In the foundation frame of the turn-table, a vertical bearing shaft is fixed, furnished at the top with a steel centre step; to the under side of the turn-table, a circular flange is attached, from the centre of which a conical pivot projects, the apex of which is of steel, and works in the centre before described. A metal cylinder projects downward from the table, within which, at top and bottom, two gun metal collars work freely round the bearing shaft. At the lower part of this cylinder an external flange is cast, from which stay-bars proceed to the underside of the table, near its outer edge. When a carriage is placed upon the table, the pivot revolves in the steel centre step, while the gun metal collars take a bearing round the vertical shaft, and steady the whole.

The improved castors for furniture consist of a hollow iron cylinder, closed at top, and having a flange at bottom, by which it is riveted to a socket; the interior of this cylinder is conical at top, and enlarged at bottom, and on the outside of the enlarged part a screw is cut, for the reception of a screwed cap. Within the cylinder there is a cylindrical iron pin, the upper end of which is capped by a cone, the diameter of whose base exceeds that of the cylindrical part of the pin, and to the lower end the horns of the castor are fixed. The cone rests upon the upper edge of a cylindrical collar, which fits loosely round the pin; the bottom of this collar is flanged, and rests upon the cap above named, which is screwed to the lower part of the cylinder, the cap having a central aperture, through which the cylindrical pin passes.

The improvements in the axles of wheels are as follows:—A collar is welded near the end of the axle, having an annular space for containing oil; against the front of the collar, and moving freely on a step, is a loose collar, and on a smaller step, at the end of the axle, there is a similar collar. A turned steel collar is placed behind the fixed collar, and against it a turned flange is placed; against this flange, and entirely covering the outside of the same, there is a brass boss or collar fastened to the axle by screws. The axle-box is next put on the axle, having an adjustable iron plug screwed into its outer end, the conical extremity of which fits into a corresponding cavity in the end of the axle; the plug is kept in its place by a brass cap, which is screwed on to the end of the axle-box, and the box attached to the fixed collar by screws. The oil is supplied through a hole bored transversely into the axle, from whence it is conveyed by a longitudinal hole round the axle and into the various crevices in order to lubricate the parts. In order to prevent all unnecessary play between the axle and the box, a series of notches are cut in the recess of the axle-box, in which the plug is screwed, and on the screw plug another series of equidistant notches are made, and so arranged, that only one notch in each coincides at one time; whenever this coincidence occurs after the adjustment has been made, by screwing or unscrewing the plug, a square steel key is put into the cavity formed by the two coincident notches. All motion in the screw plug is thus effectually prevented, and the parts are kept in adjustment by screwing on the brass and cap. This arrangement admits of many modifications, several of which are described.

The claim is, 1, Generally, to the combination of parts which constitute the turn-table for railways hereinbefore described; and separately considered, the loose cylindrical collars and pivots, or points smaller than the cups they work in, employed as anti-friction mechanism in turn-tables. Also the stay-bars radiating from a central vertical shaft or centre of motion, to support the table.

2, To the same loose cylindrical anti-friction collars or rings, when applied to castors for furniture, and the pivots hereinbefore described, applied in connection therewith. As also the mode of supporting the vertical shaft and the collar as shown, and which collar is especially applicable to support the lower friction collar of the turn table.

3, The same loose cylindrical anti-friction collars, or rings, as applied to the axles of carriages, and combined with the screw plug for preventing the end motion of the axle in the box, and the method of preventing the said plug from becoming unscrewed, therein shown, by means of the ring-key, the leather collar lying in a metal collar, which is pressed forward by springs, for the purpose of preventing the escape of oil; and the fast collar by which the loose collar is retained in its place; and the whole of which mechanism is equally applicable to the vertical shafts of turn-tables.

4, To the same loose cylindrical anti-friction collars applied to the collars of lathes, to the axles of pulley-wheels, the pins of hinges and other similar articles.

Abraham Alexander Lindo, of Liverpool-street, Finsbury-circus, Gentleman, *for improvements to be applied to railways and carriages thereon, to prevent accidents, and to lessen the injurious effects of accidents to passengers, goods, and railway trains.* Enrolment Office, June 18, 1841.

The first part of these improvements consists of a self-acting apparatus for shutting off the steam from the cylinder of the engine, and sounding a whistle, which is accomplished by the following means:—From the underside of the platform of a locomotive engine two iron rods are suspended by eye-bolts, their upper ends, which are bent, being inserted into the eye-bolts, so as to allow the lower ends of the rods to vibrate to and fro, these lower ends having a horizontal rod attached to them. Near the upper end of the rods two horizontal iron plates are hinged in such a manner as to be capable of moving upwards into a vertical position, but incapable of falling below the horizontal position. On these plates a weight is placed, attached by chains to the handles of the regulator and steam-whistle. At any places on a line of railway, where it is desirable to cut off the steam and sound the whistle, a staff is placed in the centre, or at the side of the rails, which, being raised into a perpendicular position, and coming in contact with the horizontal rod before mentioned, causes it to vibrate, by which means the plates are drawn from under the weight, which falls, and, by pulling the chain, shuts off the steam from the cylinders and sounds the whistle. As soon as the engine has passed the staff, the rods resume their vertical position, and remain stationary; the engine-driver then lifts the weight up between the plates, by means of the chains, and the plates resuming their original position, the weight is placed upon them.

The second improvement consists of a "pioneer," and a life-preserver: the former for clearing the rails of any obstructions that might be on or near them, and also for applying the breaks; the latter for picking up men or animals from off the rails.

The "pioneer" is formed of iron bars, and is attached at the top (in a vertical position) to the fore part of the engine, so as to be capable of sliding back a short distance on coming in contact with any considerable obstruction on the rails, or with a train on the same line of rails. At the lower part of the pioneer there is a pair of shares for clearing the under portion of the rails of all obstructions that might interfere with the flanges of the wheels; the upper surface of the rails is cleared by brooms, also attached to the framing. The hinder part of the pioneer is connected with the breaks of the engine, as also with the regulator and whistle; so that, on coming in contact with another train, it applies the breaks, shuts off the steam, and sounds the whistle. The life-preserver is a horizontal frame, attached to the lower part of the pioneer by a connecting-rod, and by stays jointed in the middle, so as to be raised out of action, when not required, by a chain or rope. The couch of this life-preserver is covered with thick soft padding or mattresses, which, overhanging the front, are continued to within a short distance of the top of the rail. By this apparatus, men or animals lying on the rails will be caught up in the couch of the life-preserver.

The third improvement consists of what the patentee terms "a clamp and stay," to be attached to railway carriages, &c., to prevent their running off the rails, and to support them in the event of the wheels or axles breaking. To the under side of the carriage an upright circular shaft is attached, the lower end of which is forked, and terminates in horizontal arms extending outward; between the forks is a large guide-wheel, which runs on a centre rail, laid along the line. To the horizontal arms of the circular shaft the upright arms of two clamps are attached, consisting of an horizontal and an upright arm in one piece, the former extending inwards towards each other, and terminating in a ball and socket, which nearly touches the sides of the centre rail. On each horizontal arm a small vertical wheel is placed, near its end, nearly touching the under part of the centre rail. Should the train diverge from the proper track, the small wheel and the ball and socket on one side of the centre rail will bear against the side and under part of that rail, and thereby prevent the carriages from getting off the rails. Should a wheel or axle break, the carriage will be supported by the large wheel of the upright shaft.

The fourth improvement is, a buffer carriage to be placed before the engine, and behind the last carriage of a train. It consists of two rectangular iron cases on wheels, the larger serving as a sort of sheath for the smaller; the interior of each case is occupied with wooden frames, on which circular mattresses are suspended; these mattresses are lightly stuffed with some soft materials, and extend from one frame to another. The frames are connected with each other by spiral springs, from between every two frames. The back end of the large case, and the front of the smaller are closed, forming the ends of the buffer carriage, which are well padded with soft elastic substances; the other ends are open.

On two trains thus provided coming in collision, the cases will be pressed together, when the yielding of the mattresses will lessen the violence of the concussion. Other modifications of buffer carriages are described; in one of them, a cylinder partly filled with water is placed in one case, while a piston is attached to the other.

The last improvement relates to the transmission of railway signals; station-houses are placed along the railway, about a mile apart, open in front, but closed at the back and sides. In each side of the house there is an opening, closed by flaps, the interior of which is convex, the exterior plane. Midway between these openings a gong is suspended, and when it is desired to sound the gong, in either direction, the flap on that side is raised, and the opposite one closed. In a space behind the house there is a pillar, with a lamp at top, having white glass front and sides; three panes of green glass are hinged to the bottom, so as to be raised over the white when necessary; three red panes are hinged to the top, so as to be lowered over the white. The top of the lamp is also furnished with tin shades, which can be so used as to throw the light in any one direction only.

DAVID WALTHER, OF ANGEL-COURT, THROGMORTON-STREET, MERCHANT, *for certain improvements in the methods of purifying vegetable and animal oils, fats, and tallows, in order to render those substances more suitable to soap making, or for burning in lamps, or for other useful purposes, part of which improvements are also applicable to the purifying of the mineral oil or spirit, commonly called petroleum or naphtha, or coal oil, or spirit of coal tar.*—Rolls Chapel Office, June 23, 1841.

These improvements consist simply in passing a supply of high pressure steam through a perforated plate of metal, which finely-divided currents of steam pass up through a quantity of such oils, fats, or tallows, while they are kept enclosed within close strong vessels, and subjected to the compressure and temperature due to the high pressure steam, which is afterwards permitted to make its escape through loaded safety valves; by which means the impurities, or a certain part of them, will be carried away. Or another method consists in collecting and cooling the waste steam, in order to preserve such parts as are worth preserving, or to avoid the unpleasant smell that might arise from allowing them to escape into the atmosphere.

The pressure and temperature of the steam is to be applied for about five or six hours, being continually increased until the pressure is equal to four atmospheres. The patentee proposes to operate upon the oils in the raw state, or after they have been treated with sulphuric acid, and washed with water; or in any stage of incipient purification. The compressure and temperature of the steam having been progressively increased to the extent stated, all the impurities will be carried off, and the oil, fat, or tallow remaining in the close vessel will be left in a purified state, and only requiring to be drawn off, cooled, separated from the water, and then filtered, in order to be fit for sale. The patentee does not confine himself to any particular form of apparatus, although every atom of the implements employed, and all the minutest details of the process, are explained with a technical verbosity, which is altogether superfluous. The consequence therefore is, that the specification, which could have been very fully and clearly described in *one* skin of parchment, is made to occupy *seven!*

The following description of the invention, illustrative of the claim, will afford a fair specimen of the diffuse and wordy style of the whole.

"Firstly, the improvement hereinbefore described of passing a supply of high pressure steam through perforations, by which it is divided into numerous currents, which are passed upwards through quantities of vegetable or animal oils, fats, or tallows, whilst the same are enclosed within close vessels, so as to be subjected to the compressure and temperature due to such high pressure steam, and which high pressure steam, after having so passed in such divided currents, makes its escape through loaded safety valves as waste steam, carrying away with it so much of such volatile impure portions, (which give an offensive smell,) as will leave the said oil, fat, or tallow in an improved state as to purification, after having been submitted (in the manner hereinbefore described) to the operation of such divided currents of high pressure steam. The said operation being performed upon vegetable or animal oils, fats, or tallows, either when the same are in their most gross, raw, or impure state, in which they are commonly bought and sold as current articles of commerce, or else being performed when the same are in any state or stages of purification to which they may be brought by means of those methods of purifying vegetable or animal oils, fats, or tallows, which are commonly known and practised for that purpose.

"Secondly, in the improvement hereinbefore described of cooling, condensing, and collecting that waste steam which after having been passed in divided currents through quantities of vegetable or animal oils, fats, or tallows, and escaped therefrom through loaded safety-valves as waste steam, carrying with it volatile impure portions of the said oils, fats, or tallows, as already mentioned under the first head of improvement, in order that by so cooling, condensing, and collecting (according to the second particular of improvements,) the said volatile impure portions may be collected, (in order to avoid nuisance by their dissipation in the air,) or preserved for such use or uses as they may be fit for.

"Thirdly, the improvement hereinbefore described, of separating the more liquid portion of vegetable concrete oils, or a fat, or tallow, leaving the more concrete parts thereof in a purified state, by passing divided cur-

rents of high pressure steam through quantities of such concrete oils, fats, or tallows, when the same are enclosed within close vessels, and subjected to the compressure and temperature due to such high pressure steam, the said steam afterwards escaping through loaded safety-valves, and carrying with it portions of such oil, fat, or tallow, and the steam after so escaping being cooled and condensed, together with the said portions so carried with it, in order that those portions, when collected, may be preserved as the more impure portion of the concrete oils, fats, or tallows; and also that by the separation thereof from such oils, fats, and tallows, the remainder thereof will consist of the more concrete portions in a purified state, so as to be more suitable for soap-making than without the said separation.

"Fourthly, the improvements hereinbefore described of purifying the mineral or spirit, commonly called petroleum, or naphtha, or coal oil, or spirit of coal tar, by separating therefrom the more volatile portion thereof, which chiefly contributes to give an offensive smell thereto (or separates part of that said more volatile portion which chiefly contributes to give an offensive smell thereto,) by passing divided currents of high pressure steam through quantities of such mineral oil, or spirit aforesaid, whilst the same is enclosed within close vessels, so as to be subjected to the compressure and temperature due to such high pressure steam, after being so passed in such divided currents, makes its escape through loaded safety valves, as waste steam, carrying away with it the more volatile parts aforesaid, which chiefly contributes to give an offensive smell (or part of such portion), leaving the remaining mineral oil, or spirit aforesaid, in a more purified state. Also preserving such volatile portions of the mineral oil or spirit (as has been so carried away with the waste steam,) that being done by means of cooling, condensing and collecting such waste steam in manner hereinbefore described, so as that the liquid resulting from the cooling and condensation of such said portion (or part thereof) may be reserved for any such use or uses as the same may be fit for; or if too offensive to be fit for any use, then the nuisance which would be occasioned by the dissipation thereof in the air, may be avoided by so collecting such portion."

JOHN BRUMWELL GREGSON, OF NEWCASTLE-UPON-TYNE, SODA WATER MANUFACTURER, *for improvements in pigments, and in the preparation of the sulphates of iron and magnesia.*—Enrolment Office, June 23, 1841.

This invention consists, first, in the preparation of Venetian red by an improved method; Secondly, the preparation of a new black pigment; Thirdly, an improved mode of making copperas, or sulphate of iron; and Fourthly, an improved mode of making sulphate of magnesia.

In manufacturing Venetian red, a solution of chloride of iron is poured into a vessel containing hydrate of lime, in the state of cream of lime, constantly stirring the mixture until all the lime is converted into chloride of calcium, to insure which, the chloride of iron is used in excess. The oxide of iron thus obtained is well washed with water, and then dried, and afterwards mixed with two or three times its weight of gypsum (sulphate of lime) in powder, and the mixture exposed to a red heat in a reverberatory furnace for half-an-hour, till it assumes the well known colour of Venetian red.

In the ordinary process of manufacturing Venetian red from sulphate of iron and gypsum, these substances in equal proportions are calcined in a reverberatory furnace for seven or eight hours, or until the whole of the sulphate of iron is decomposed, and the sulphurous acid given off is dissipated along with the carbonaceous matter of the fuel. In order to convert such sulphurous acid into sulphuric acid, the patentee causes this decomposition to take place in a retort, and passes a current of air or steam through such retort, by an apparatus adapted for that purpose.

The method of preparing a black pigment, not hitherto made, is as follows: — Any quantity of oxide of iron obtained from the chloride as above described, or as it is found to exist naturally in certain clays, &c. or as it may be prepared by various processes, is introduced in a state of powder into a retort, resembling an ordinary gas retort, but lighter, placed either vertically or horizontally in a suitable furnace. When the retort is red-hot it is removed from the furnace, and its mouth closed, a pipe is then attached to it, and hydrogen gas, or carburetted hydrogen gas, forced into the retort until inflammable gas issues from a perforation at the opposite end of the retort. The perforation is then closed, and the materials kept from contact with the atmosphere until cold. The oxide of iron is thus converted into a protoxide which forms the black pigment, and is to be prepared for use by grinding and washing in the usual manner.

For making copperas or sulphate of iron, the patentee takes the slag abundantly produced in the balling-furnaces of iron-works, and reduces it to a fine powder. Into a shallow leaden vessel capable of holding fifty gallons is put about 100lbs. of this powdered silicate of iron made into a thin paste with water; 100 lbs. of sulphuric acid (specific gravity 1.845) previously diluted with its own weight of water is then added, the mixture being constantly stirred. The sulphuric acid combines rapidly with the oxide of iron, much heat being evolved; when cold an impure

mass of sulphate of iron remains which is dissolved in its own weight of water, and allowed to stand till clear, when it is drawn off, evaporated, and crystallized in the usual manner.

For making sulphate of magnesia 100 lbs. of magnesian limestone is put into a retort (resembling a gas retort, and set in a furnace in the same manner), and kept at a low red heat for two or three hours, or till it ceases to give off carbonic acid gas; it must then be removed from the retort and allowed to cool. One hundred pounds of crystallized sulphate of iron is dissolved in an iron boiler in about three or four times its weight of water, the calcined limestone is then stirred in and boiled for about an hour, when by the reaction of the magnesia the sulphate of iron is decomposed, and sulphate of magnesia formed. The solution must now be tested with prussiate of potash, and should it be found to contain iron, a further quantity of magnesian limestone must be added, until the iron is entirely precipitated. After standing, the clear solution of the sulphate of magnesia is to be drawn off, evaporated, and crystallized. The sediment may be further washed to remove all the sulphate of magnesia, it is then to be dried and calcined at a red heat, after which it may be used as a brown pigment.

JOHN DICKINSON, OF BEDFORD ROW, ESQ., *for certain improvements in the manufacture of paper.* —Rolls Chapel Office, June 23, 1841.

These improvements relate to sizing of paper continuously, by the mode of unwinding a roll of dried paper from a reel of ordinary dimensions, and conducting the paper through heated size of the ordinary strength, and after pressing out the superfluous size, re-winding the paper on another reel, the whole being performed in an air-tight chamber or vessel, partially exhausted of air, in the manner described in a former patent, dated October 17, 1839.

The apparatus employed for the foregoing process consists of a strong cast-iron vessel, having a flanch round the top, and also a cross-bar in the middle, with a flat wide upper surface. The whole of the surrounding flanch and cross-bar are made perfectly smooth and level on the top-side. This vessel is closed in by two lids, each of them in the form of half a hollow cylinder, and having a smooth bottom flange, and furnished with joints by means of which the lids may be opened for the purpose of placing and removing the reels of paper. When these lids are closed, they meet in the centre of the before-mentioned cross-bar, and the surfaces being all properly smooth and level, all the joints are rendered air-tight by means of leather washers and tallow in the usual manner. A reel filled with dried paper being placed in the vessel, the end of the paper is led down under horizontal guide-rollers placed in the lower part of the vessel between pressing rollers up to the empty reel to which it is attached. The lids are then closed, and the air pumped out by a double acting air-pump until a degree of exhaustion is produced capable of supporting from 20 inches to 25 inches of mercury. Hot size is then admitted from a boiler into the vessel, and the level maintained at one uniform height. Pieces of plate-glass are fixed with air-tight joints on each side of the vessel, in order that the level may be watched, and also that the exhaustion may not be carried so far as to create a great ebullition of the size, and for this purpose an inverted safety valve is attached to the vessel. One of the reels has a small pinion on its spindle, which works into another pinion on a smaller spindle placed below it, which passes out through a stuffing-box in the side of the vessel, by means of which motion is communicated to the internal apparatus from any suitable prime mover while the joint is kept air-tight. The paper being thus led and fixed as above stated, the air exhausted and the size supplied, the working is commenced, and as the paper is gradually unwound from the first reel, it passes down under the guide-roller, through the size, between the pressing-rollers up to the empty reel upon which it is wound, such a speed being given to it as is adapted to the particular texture and thickness of the paper operated upon.

The paper may be prevented from wrinkling or bagging in passing through the size, by a well known process of causing it to draw or slip over a board or copper plate with ribs diverging from the centre at an angle of about 45 degrees, by which means the paper is supported and gradually extended as it expands in soaking. The containing vessel should be furnished with a barometrical and thermometrical gauge to show the degree of exhaustion and the temperature of the size. A float is suspended within the vessel, occupying a large portion of the space between the guide-rollers, for the purpose of diminishing the surface of size exposed to evaporation.

There is also an enclosed space under the bottom of the vessel, into which steam or hot water is introduced as required for keeping the size at the proper degree of temperature.

GEORGE THORNTON, OF BRIGHTON, CIVIL ENGINEER, *for certain improvements applicable to railways, locomotive engines, and carriages.* — Rolls Chapel Office, June 23, 1841.

This invention comprises various improvements under three heads, viz., railways, locomotive engines, and carriages.

First, with regard to railways, the patentee

observes that "the original gauge of 4ft. 8½in., and the more recent improvement of 5 feet, have both been found in practice to be too narrow to admit of a proper and free arrangement of the machinery of the locomotive engine, and also creating at great speeds an unpleasant transverse oscillation of the carriages, with the liability at high velocities to fly off at a tangent from quick curves. On the other hand, the 7 feet gauge appears to entail too great a weight in the construction of the locomotive engines and carriages, and consequently a proportional expense, this increased weight and width of gauge also involving a considerable increase of outlay in land, and construction of the railway and bridges. Looking then at the question fairly between the existing gauges of rails, it would seem desirable that some medium or national width should be adopted, and the simple gauge of 6 feet (or thereabouts) presents itself as admitting a desirable width for convenient arrangement of locomotive engines and carriages, without extreme weight or expenditure in any department. In explaining the next head of my invention, (improvements applicable to locomotive engines,) I would observe that it has been found in practice that a 6 feet wheel is as high as can be usefully employed, so as to combine the two advantages of power and speed, and it seems to be in mechanical unison with the 6 feet gauge. I would also propose to make the flanges of the wheels of the locomotive engines and carriages deeper than they now exist, viz., to not less than 2½ inches, which would greatly tend to lessen the liability of engines and carriages getting off the rails.

The improvements in locomotive engines consist, 1st, in the application of a self-acting governor to the steam-pipe, which in all cases regulates the power of the engine, and prevents excess of speed, (beyond that to which the governor is adjusted,) which is at present at the discretion of the engine-driver. The governor thus employed is the common pendulum governor, encased by a dome on the top of the boiler, acting on a throttle-valve in the steam-pipe in the ordinary way. 2. In the use of a self-acting water governor or regulator, which preserves an equable height of water in the boiler. The water regulator is a spherical copper float, acting on a vertical spindle, which works through a stuffing-box in the top of the boiler, acting on a valve in the water-pipe. 3. In encasing and surrounding the smoke-box with a stratum of water, which is pumped into this auxiliary directly from the tender, there retained by means of a stop-valve, and thence admitted as required into the boiler, after absorbing the hitherto waste heat escaping from the tubes, and preventing the burning out of the plates of the smoke-box and chimney, the steam pipes and steam chest cover in, which till now has been a common occurrence, and a great desideratum to avoid. 4. A tube in connection with the safety-valve on the boiler, which tube carries off the surplus steam into the chimney, thus increasing the draft, doing away with much disagreeable noise, and preventing the steam, as heretofore, from flying in the face of the driver and obstructing his view of the line. 5. In the employment of a universal jointed pipe, connected with the bottom of the boiler at the chimney end, for the purpose of clearing out the boiler tubes, by directing a jet of hot water and steam through them; thus more speedily effecting the desired object, than by the present imperfect method of using a rod of iron with tow at the end. Lastly, as regards locomotive engines; in the use of self-acting breaks on the wheels, which breaks are raised by the pull of the engine, through the medium of an apparatus for that purpose, between the engine and tender, which, when the engine ceases to draw, (either from necessary or emergent causes,) descend upon the wheels with great force, and stop the engine; these breaks being also further available, under the discretionary use of the engine-driver.

The third head of these improvements refers to railway carriages, and consists in the application thereto of self-acting breaks lifted off the wheels by a traction-rope, in connection with, and pulled by the engine; and which fall upon the wheels whenever the rope becomes slack, and thereby stops the carriages.

By this traction-rope, the engine draws and works considerably in advance of the train, so that in case of collision, of the engine upsetting, running off the rails, &c., the rope immediately becomes slack; and the breaks falling forcibly upon the wheels, bring up the carriages before the train reaches the scene of danger.

The length of traction-rope between the engine and train prevents any danger to life and property from accidental explosion; it also prevents the igniting of goods-trains by sparks issuing from the engine chimney. On one of the axles of the tender a drum and apparatus are fixed, for letting out the traction-rope to such lengths as may be required, to suit the curves of existing railways, in which the rope is peculiarly serviceable, by always pulling round the trains from a tangential direction, and thereby preventing the danger of a train flying off the railway in a straight line, under high speeds. This rope may also be wound up by the same drum, to such length as may be required to draw up the trains into their proper position in existing stations or termini. It may be necessary to observe, that the letting out or taking up of the rope can be accomplished without any interruption to the progress of the train.

The carriage breaks consist of a draw-bar under each carriage in the train, connected at each end by buffers and chains; on this bar there are two wedge inclines, over which a pulley works in connexion with the weigh-bar and breaks, and in the centre of the carriages around the draw-bar is a helical spring, having a double action against two collars. When the engine begins to move, the bar is pulled forward, the pulley rises in the guides, and with it the break rises from all the wheels of each carriage throughout the train. When the engine stops, the spring draws the bar into its place, lets the breaks down upon the wheels with sufficient force to stop the train within any required distance.

The claim is 1, To a kind of medium gauge, (say about 6 feet) of the rails upon railways calculated to afford the advantages alleged at the outset. 2. In reference to locomotive engines; firstly, the use of wheels with an increased flange; secondly, an arrangement of apparatus by means of which the speed of the engine is regulated with much greater precision without the agency of the driver; thirdly, a self-acting water-gauge, or regulator; fourthly, a preparatory heating of the water supplied to the boiler for the formation of steam, by a vessel inserted in the smoke-box; fifthly, a mode of conducting the waste steam, attended with the advantages hereinbefore set forth; sixthly, a method of clearing out the tubes of the boiler with more efficiency and dispatch than by the present practice; and lastly, a means of stopping the engine by the use of self-acting breaks upon the wheels.

3. Under this head the patentee claims the use of self-acting breaks raised from off the wheels of the carriages by the pull of a traction rope descending with impeding force simultaneously upon all the wheels in a train when the rope ceases to operate upon them by its being slack, according to local circumstances.



## LIST OF SCOTCH PATENTS GRANTED BETWEEN THE 24TH MAY AND THE 22ND JUNE 1841.

Edward Henshall, of Huddersfield, York, carpet-manufacturer and merchant, for certain improvements in making, manufacturing, or producing carpets and hearth-rugs. May 24.

William Petrie, of Croydon, Surrey, gentleman, for a mode of obtaining a motive power by means of Voltaic electricity applicable to engines, and other cases where a moving power is required. May 24.

Moses Poole, of Lincoln's inn, Middlesex, gentleman, for improvements in the manufacture of fabrics by felting. May 24. (Being a communication from abroad.)

William Joest, of Ludgate-hill, London, merchant, for improvements in propelling vessels. May 24. (Being a communication from abroad.)

Andrew M'Nab, of Paisley, Renfrew, North Britain, engineer, for certain improvements in the manufacture of bricks. May 26.

Christopher Nickels, of York-road, Lambeth, Surrey, gentleman, for improvements in the manufacture of mattresses, cushions, paddings, or stuffings, and in carpets, rugs, and other napped fabrics. June 1. (Being partly a communication from abroad, and partly invention of his own.)

John Clay, of Cottingham, York, gentleman, and Frederick Rosenberg, of Sculcoates, York, gentleman, for improvements in arranging and setting-up types for printing. June 3.

Sir Samuel Brown, knight of the Royal Hanoverian Guelphic Order, Commander in Her Majesty's Navy, of Netherbyres-house, Ayton, Berwick, for improvements in the means of drawing or moving carriages and other machines along inclined planes, railways, and other roads, and for drawing or propelling vessels in canals, rivers, and other navigable waters. June 4.

William Brockedon, Esq., of Queen-square, Middlesex, for a composition of known materials, forming a substitute for corks and bungs. June 9.

John Lambert, of No. 12, Coventry-street, in the parish of Saint James, Westminster, gentleman, for certain improvements in the manufacture of soap. June 10. (Being a communication from abroad.)

Richard Laming, of Gower-street, Bedford-square, Middlesex, surgeon, for improvements in the production of carbonate of ammonia. June 14.

Joshua Field, of Lambeth, Surrey, engineer, for an improved mode of effecting the operation of connecting and disconnecting from steam-engines the paddle-wheels used for steam navigation. June 16.

Andrew M'Nab, of Paisley, Renfrew, North Britain, engineer, for an improvement or improvements in the making or construction of meters, or apparatus for measuring water or other fluids. June 21.

Joseph Maudslay, of Lambeth, Surrey, engineer, for improvements in the arrangement and combination of certain parts of steam-engines, to be used in steam navigation. June 21.

John Condie, of Blair Iron-works, Ayr, in the kingdom of Scotland, for improvements in applying springs to locomotive and railway and other carriages. June 22.

George Richard Elkington and Henry Elkington, of Birmingham, Warwick, for improvements in coating, covering, or plating certain metals. June 22.

Moses Poole, of Lincoln's-inn, Middlesex, gentleman, for improvements in producing and applying heat. June 22. (Being a communication from abroad.)

## LIST OF IRISH PATENTS FOR JUNE, 1841.

J. J. Cordes and E. Locke, for a new rotary engine.

J. Johnson, for certain improvements in machinery for the manufacture of frame-knitting, commonly called hosiery, and for certain improvements in such frame-work knitting or hosiery.

G. D. Paterson, for the following improvements in curvilinear turning, that is to say, a rest adapted for cutting out wooden bowls, and a self-acting slide-rest for other kinds of curvilinear turning.

H. S. Pattinson, for improvements in the manufacture of white lead.

John Rand, for improvements in preserving paints and other fluids.

N. Defries, for improvements in gas-meters.

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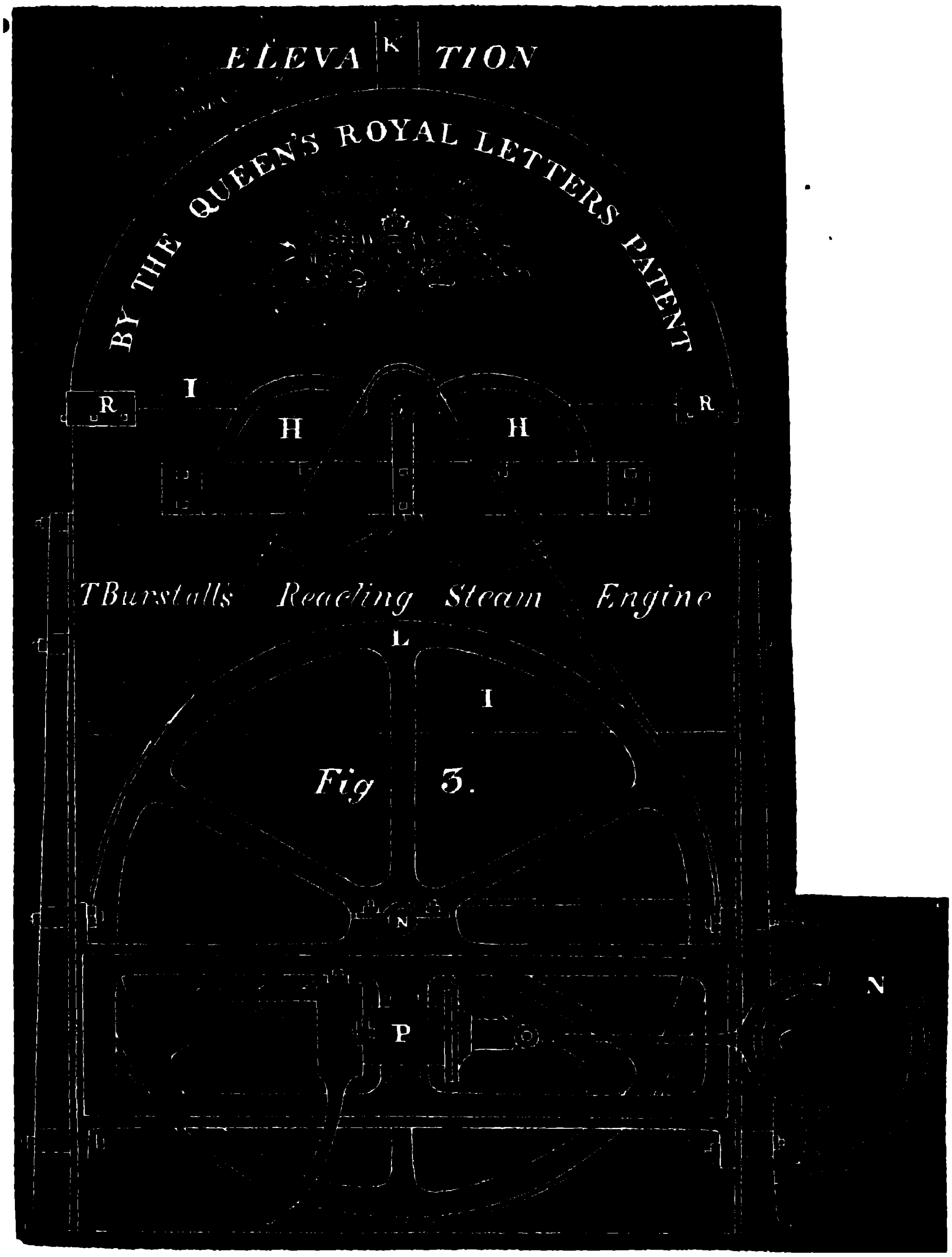
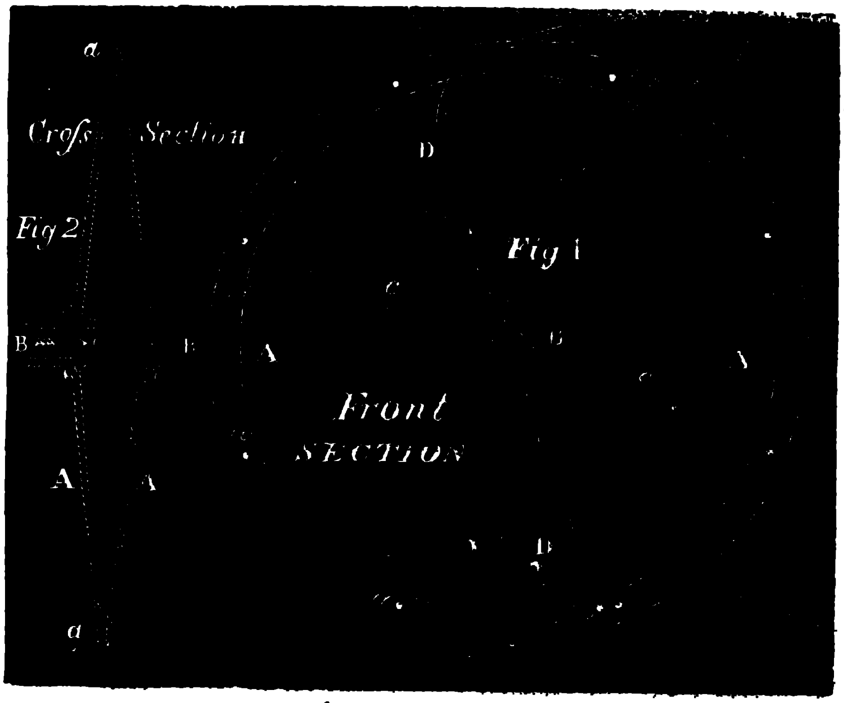
## BURSTALL'S PATENT RE-ACTING STEAM-ENGINE.



## MR. T. BURSTALL'S PATENT RE-ACTING STEAM-ENGINE.

Sir,—This engine is on the principle of Barker's Mill, and consists of two or more tubes inserted into a hollow shaft, the tubes being bent or bored, so as to deliver the steam in a tangent to the circle in which they travel. To prevent the obstruction which would arise from the tubes striking the air or steam in which they revolve, these tubes are inclosed within, and attached to two slightly conical circular plates, which may be either of iron, copper, or brass, but must be turned or hammered as true as possible; this will insulate the tubes, and instead of the arms cutting their way through the air or steam a true metallic disc will move through it.

Fig. 1 (on this page) is a plan of the engine with one plate removed to show the tubes; and fig. 2 is a cross section through the central hollow shaft and the insulating plates. In fig. 1 are shown four tubes, with their exit orifices reversed: this double set of tubes is to facilitate the reversing the engine, as would be more particularly requisite for locomotive purposes, and this is accomplished in the following manner: The central shaft B is hollow throughout, except in the centre, in which there is a partition, or stop, the two sets of tubes being inserted one on each side of this partition, and the steam being admitted by separate pipes and valves



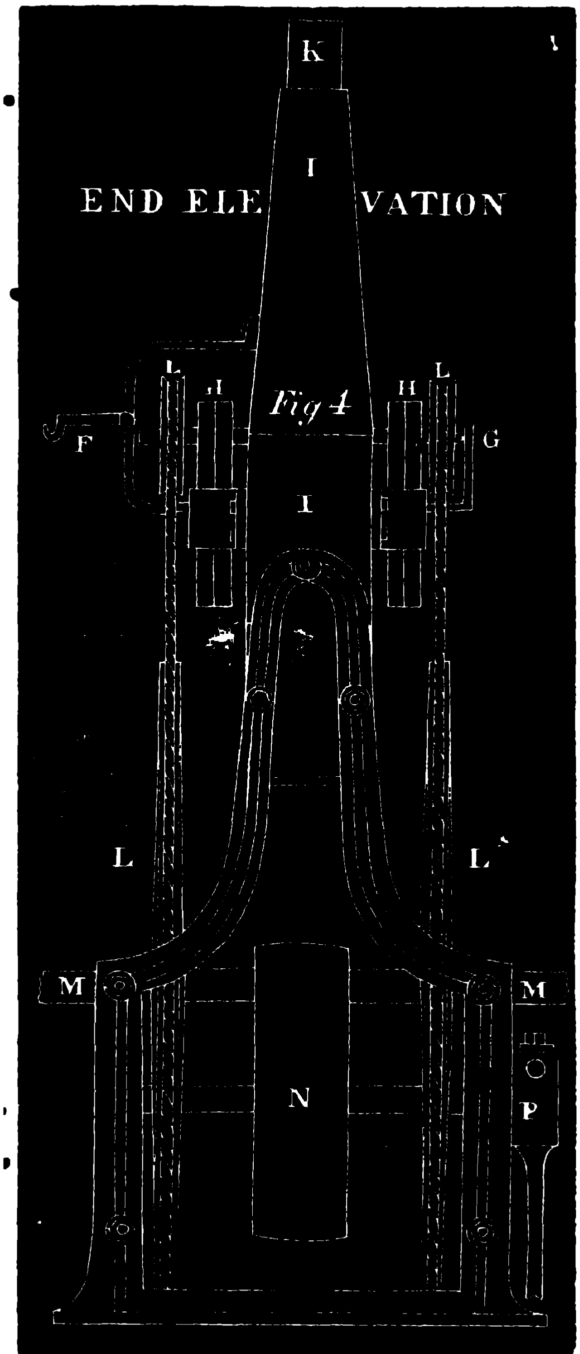

into each end of the central tubes; all that is required to work the engine backward or forward, is to shut off the steam from one pipe and turn it on to the other.

Fig. 3 (see front page) is an elevation of the whole engine, steam case, framing and driving drums, and fig. 4 is an end view of the same. The engine spindle is mounted, and revolves upon two pair of anti-friction wheels H H, fixed to the steam case I I, in which the engine revolves, and which case is for the purpose of taking off the steam by the tube K, to the chimney or other outlet from the building; the power is conveyed from the engine shaft by two pulleys fixed upon it, to two drum wheels, by two flat belts, and if required, by a second belt on the drum N. P is a feed pump to supply the boiler, and may be worked by a crank or eccentric from the shaft which carries the drum N.

F G, in the end view, fig. 4, are a steel stud and lever to carry a weight to keep the steam pipe sufficiently tight to the central shaft, into which they are to be fitted and grooved, and by the lever being weighted a trifle above the pressure of the steam, the engine may be worked with the minimum of friction.

As you have lately had several articles on Avery's steam engine, and on Craig's importation of it into this country, it may not be out of place to point out the principal differences between my

engine and his, leaving it to the judgment of your readers as to whether they are improvements or not.




In Avery's engine, the arms, though shaped to cleave the air, yet have to make their way through it, and with so great a speed, that they must have a considerable pressure in front, with some vacuum behind, causing a material loss of power; while this engine, instead of cleaving the air, moves through it with a true and polished surface. The double set of arms, and double steam ways, give great facility in reversal, and without much additional cost.

Having seldom known the power of this engine calculated in a way that I could consider satisfactory, perhaps you will permit me to state my views of it. I have generally found it considered that the re-action arose from the elastic steam issuing from the engine, re-acting against the steam in which the engine revolves. That some power is got from that source I admit, but the principal power is, I think, got from the re-action of the steam as a ponderable body put in rapid motion. If we take the water to be converted into steam, as is usually done at one cubic foot per horse power, this gives 1 lb. of steam or water per minute, and as 50 to 80 lbs. of steam pass through a proper shaped orifice at a velocity of about 1,800 to 1,900 feet in a second, or say, $\frac{1900 \times 60}{33000} = 3\frac{15}{33}$; therefore, is the power required to move 1 lb. with a velocity of 1,900 feet the second, or 114,000 feet per minute. But as this engine will do the most work when it moves about half the speed of the steam no more than about $1\frac{1}{2}$ horse power can be got from 1 cubic foot of water evaporated in an hour—which is half as much more than is generally required with a cylinder engine.

I am, Sir, yours truly,

T. J. Burstall.

Bath, June 22, 1841.

## ON THE PERFORMANCES OF THE CORNISH ENGINES.

Sir,—In resuming this subject, I wish in the first place to assure "Scalpel" that, entertaining no suspicion of his views respecting the great value of the Cornish method of condensation having been derived from others, I thought it quite unnecessary to advert to that point; to many persons his assurance to this effect may prove satisfactory; to me, it merely confirms my previous opinion; still it was an act of justice to point out to the public an unnoticed paper by Mr. E. Galloway, in which an estimate of the proportional value of this plan of condensation, more in accordance with my own ideas, had been brought forward. I consider it uncertain, whether it is founded on Mr. Galloway's observations, or on the opinion of the miners, who, I am inclined

to think, attach some importance to the circumstance—that an appreciable time should be allowed between each stroke of the engine for the purpose of effecting a more complete condensation in the cylinder.

I hastened to point out more clearly than in my former letter, that no argument against "Scalpel's" views could be founded on the slow stroke of the Cornish stamping engine—fearing, as the result proved, that the limitation, that the "*subject was only brought forward for the purpose of pointing out the propriety of strict definition of the class of rotative engines*," might be insufficient.

Some doubt did exist in my mind, whether the Cornish engineers had not derived their method of condensation from Watt, as they succeeded to the care of his engines after 1800. Holding opinions similar to those of "Scalpel" respecting Watt's knowledge of condensation, as derived from his original and most beautiful experiments on a small scale, and subsequently proved on the largest scale, I fancied the advantage of such a plan could not have escaped his notice; especially as slow speed, so often required in mining engines, must from the earliest period have afforded an opportunity for the trial of this plan, by means of the cataract employed for the regulation of the number of strokes per minute. If it should be proved, (and the fact seems admitted,) that Watt was unacquainted with this expedient for the improvement of cylinder condensation, perhaps an interest may be felt in ascertaining to whom among the mining engineers the improvement may be attributed, and when and where it was effected.

In regard to "Scalpel's" first deduction, though the meaning is obvious, yet the propriety of the term "duty," as derived from indicators attached to rotative engines, when contrasted with the duty of lifting engines, derived from a different cause, the weight of water raised exclusive of pump friction, seems doubtful, (see page 51, vol. iii., Trans. of Inst. C.E., Mr. Parkes's observations on Steam Boilers.)

The indicator shows the steam pressure exerted on the piston, and by making allowances for friction, &c., the effective steam pressure may be calculated by the comparison of rotative engines with each other; but confusion will inevitably arise, unless the distinction between *duty* and *effective power* is kept up. The work performed, or duty of stamping engines, is obtained directly from the weights lifted, and perhaps in some of the recent engines it may have been increased by the omission of a portion of the gearing for the communication of the power.

In the second deduction, it is stated, "that Mr. Watt's rotative engines consumed in 1787 an average of 8 lbs. of best coals per nominal horse power per hour. That the actual power was from one-half to two-thirds greater than they were rated at. The steam pressure was nearly always 2 lbs. less than the atmosphere, and never used expansively."

Now as the atmosphere at 30 inches of mercury, is nearly 14¾ lbs., a deduction of *nearly always* 2 lbs. will give a mean steam pressure on the piston of 12·75 lbs. The cylinder vacuum is subsequently shown to vary from 9 to 11 lbs. at this period; hence, the resistances of the uncondensed steam would be from 5·75 lbs. to 3·75 lbs. per square inch; and further, deducting the friction of the engine itself, it appears to me that the mean effective steam pressure must have *nearly always* coincided with 7 lbs. steam pressure, assumed by Watt for the basis of nominal horse power, a view that might be supported by a reference to Watt's well known accuracy.

At present, steam of less than atmospheric mean pressure is seldom used in rotative, especially marine engines; hence, the 8 lbs. of best coal per nominal horse power per hour, in 1787, seems to have represented a smaller amount of actual power than the 8 lbs. now consumed, (as I have always understood in non-expansive engines;) a few of the larger marine engines use expansion, when their power requires to be reduced, and steam tugs with higher steam, and the stamping engines in Cornwall are obviously exceptions. When 3 lbs. steam above atmosphere was used, then from one-half to two-thirds more than the nominal power was obtained; this however is clearly stated to have been the exception, as above shown.

The amount of expansion should be stated, since the theoretical difference between cutting off the steam at one-sixth and one-half is as great as

between full pressure, and steam cut off at ¼ stroke; on the whole, I think the proofs extremely defective, that rotative engines of the present day are inferior to those erected by Watt.

Watt's views I have no doubt will be confirmed whenever accurate experiments are again made relative to the amount of loss due to a less perfect vacuum, in comparison with the greater expenditure of power to raise the larger quantity of injection water, and the coal expended in raising the temperature of the water from the hot well, when thrown into the boiler. As a rough approximation, 10 degrees of heat require about $\frac{1}{100}$th of the coal, for the conversion of water into steam. I would rather urge reference to such experiments than decide on modern performances, by Watt's opinions.

I am not aware of any difference of opinion on principles between myself and "Scalpel"—difference of values to be assigned to averages can sometimes be arranged by explanations, when parties are desirous of the truth, and are not disposed to urge arguments too far. At present there seems a disposition to account for the high duty of the Cornish engines by bringing forward some favourite cause, instead of attributing it to the minute attention which the Cornish engineers pay to every available source of improvement, occasioned by a continued rivalry with each other, and a degree of publicity unknown elsewhere. Mr. Baddeley refers their superiority to the variation of the power required to move and continue motion in heavy bodies (probably Columb's experiments) —Mr. Parkes to percussion—and "Scalpel" to condensation.

Two advocates have recently joined Scalpel's cause—Mr. James Pilbrow, who has proposed an improved engine to realise similar advantages, and Mr. Boyman, who has written a pamphlet in its support.

As many persons may be unacquainted with the method of converting the 8 lbs. of coal per horse power per hour into the form commonly used in Cornwall, and as clearer ideas are obtained from figures so arranged as to be capable of direct comparison, I have submitted the following, more with a view of calling attention to this part of the subject, than of founding any decisive argument thereon.

The first difficulty is the present Cornish bushel of 94 lbs., arising, I believe, from the use of the imperial bushel of damp Swansea coal. At Herland, doubtless the Winchester bushel was used. Newcastle coal was taken at 84 lbs. the Winchester bushel; the Welsh coal always employed in Cornwall is heavier. I believe it will be in Watt's favour if the best performance in pumping was taken at 30 millions per 94lbs. of Welsh coal in 1798. Now as one horse power per hour is 1,980,000lbs. 1 foot high, 94 lbs. would give 23,265,000 pounds one foot high, provided the actual and nominal power coincided; but at one-half greater it would become 35,897,000lbs., and at two-thirds greater = 38,775,000 lbs., subject to some variable deductions for pump friction, &c., to reduce the power derived from the effective steam pressure to the duty derived from the weight of water raised.

I am not as yet prepared to admit, that the performance of Watt's rotative engines equalled that of the lifting engine at Herland, (especially as expansion was in all probability employed to some extent,) yet I do not perceive how this conclusion can be avoided, if the positions laid down by "Scalpel" are proved to be correct, and no error has crept into the estimate of actual horse power exerted, in particular instances assumed as an average.

Sir, I remain,

Your obedient servant,

S.

July 1, 1841.

### PILBROW'S CONDENSING CYLINDER STEAM-ENGINE.

Sir,—Permit me through the medium of your pages to put a question to Mr. Pilbrow, the inventor of the Patent Condensing Cylinder Steam Engine. I wish to know upon what grounds Mr. Pilbrow considers he shall gain an additional pressure per square inch, in consequence of the working piston in his condensing cylinder preventing that accumulation of air and gas which is incident to the common condensers? He assumes that such will be the case, but I think he is in error; for if 1 lb. (2 inches of mercury) of the resistance in the condensers of steam engines, arising from uncondensed vapour, consists of air or other fixed

gases, then it appears to me it would be impossible ever to obtain a more complete vacuum *by injection* than is indicated by a column of mercury of 27½ inches, taking the average standard of the barometer in this country at 29½ inch.

I am, Sir, your obedient servant,

MACHINATOR.

London, June 7, 1841.

## THE THAMES STEAMERS.

Sir,—I have read in your very useful and highly-esteemed Work of the 26th instant, an interesting account of some of the fast-going steamers on the Thames, by "Nautilus;" but to do full justice to the distinguished engineers who have constructed the engines of these remarkable boats, I must dissent from the assumption of "Nautilus"—that the *Railway* has greater speed than her sister vessel, the *Blackwall;* which question at present cannot satisfactorily be decided, as they have not yet made a voyage at the same time; one making the up voyage, whilst the other is going the down one, and, if we may infer from the time the several voyages have been made by each of these boats, we may fairly assume that the speed of the two is equal. Or, if we may judge by a voyage which I lately made from Blackwall to Gravesend, on the 11th instant, the preference in speed is due to the *Blackwall.* This vessel left the pier at the Railway terminus at 20′ 30″ past eight in the evening, and arrived opposite the church at Gravesend, 19′ past nine, having made the voyage in 58½ minutes, which is, I believe, the shortest time the passage was ever made by any steamer on the River Thames. "Nautilus" also is in error, in stating that each of these boats is fitted with a pair of 90-horse engines: the *Railway* has a pair of 50-horse engines by Messrs. Penn and son, and the *Blackwall* has a single 90, by Messrs. Miller, Ravenhill and Co. I fully agree with him in giving due praise to the performances of the *Ruby,* which boat has been lengthened since last season, and received new boilers, and I believe some changes and additions to her machinery, and certainly does great credit to those able engineers, Messrs. Seaward and Capel, who constructed the engines. It may also be presumed, that when the engines of the *Brunswick,* by the same makers, have attained their full speed (which they will soon do,) she will equal her rivals in the quickness of her passages.

By inserting this in your widely-circulated Journal, you will oblige,

Sir, a Constant Reader,

JUSTICE.

P. S. Since writing the preceding, I think it but right to inform you that I have received some particulars with respect to the *Ruby* steamer, of which I was quite ignorant before, and which also account for her great increase of speed this summer. The *Ruby,* I find, before commencing this present season, was lengthened 15 feet, and made considerably lighter by having her boilers removed, and those of a much lighter and peculiar kind (being tubular) put in their place by Mr. Seaward. These alterations have had the desired effect, and the *Ruby* is now almost equal to any steamer on the Thames in speed, and only the other day completed the passage from London to Gravesend in one hour and twenty-five minutes. The Diamond Company, I understand, are likely to make the same alterations in one or two more of their boats.

I should think Mr. Napier, when he hears this, will not be so ready to match the *Fire King* against the *Ruby* as he was last year.

July 2, 1841.

## IMPROVEMENTS IN PIANO-FORTES.

Sir,—Among the many attempts to improve that most universal of musical instruments, the piano-forte, which have been offered to public notice, none have excited the attention of musical and scientific persons more than the application of equal tension to strings of equal size, for which improvement we are indebted to John Isaac Hawkins, Esq., who applied it to the upper half of a very ingeniously constructed instrument, manufactured by him many years ago. It has since been carried throughout the entire compass, by Mr. Wornum, whose name is honourably associated with many other improvements in this instrument; and this construction has the very great advantage of standing in tune better than any other; but this advantage is obtained at the expense of the under-mentioned

defect, which in the humble opinion of the writer, more than counterbalances its advantages.

In selecting the strings for a musical instrument, especially one having a *free* vibration, as the harp or piano, it will readily appear some proportion between their length and thickness should be observed, for if we employ wire of the same diameter for a string an inch and a half long, as we use for one of four feet in length, it is obvious the stiffness of the short string must immensely exceed that of the long one, the effect of which, as might be expected, is either want of vibration in the short string, or if that be thin enough to vibrate well, want of firmness and fulness of tone in the long one.

In instruments which have equal tension applied to strings of a considerable difference of size, a yet greater defect results from deficiency of the tension of the bass strings which are not covered; nor do the different parts of the instrument remain in tune with each other, for although the unisons may stand in tune, the octaves soon become false.

The above observations do not apply with *equal* force to stringed instruments such as the bass-viol, whose sounds are sustained by friction, applied directly or indirectly to their strings; but even in these, difference in their size is indispensable to an equal quality of tone, as is evidenced by putting a gut string of the same size as the first string of a violin on to a double bass, subjecting it to the same tension, when a very thin feeble note results, far inferior to that yielded by it on the violin. The conditions of sound in a musical pipe vary so much from those accompanying the vibrations of strings, that any analogy derived from them might be considered irrelevant; but from the necessary increase of the diameter of organ pipes towards the base to preserve an equal quality of tone throughout the compass of that instrument, and the fact of the absence of that quality of tone in tube instruments of nearly equal bore, we might be almost justified in concluding that there is in all sounding bodies some proportion between the length and bulk, which is most practically advantageous.

Sir, I remain, respectfully,

16, Garlick Hill. ALFRED SAVAGE.

P.S. The writer of the foregoing observations can suggest some improvements in the construction of piano-fortes and other stringed instruments, which if it is consistent with the plan and objects of your Journal, Mr. Editor, to receive, he may at a future time send for your acceptance. [We shall be happy to receive an account of them.—ED. M. M.]

### WIRE GAUGES.

Sir,—From the nature of the business in which I am engaged, I have frequently occasion to use the wire gauge, to ascertain the thickness of sheets of metal, the same number being used to express the thickness of sheets of iron and the diameter of wire. Great difficulty is experienced very frequently in correctly ascertaining the number of thin sheets, such as are thinner than No. 24, which is, I think, about $\frac{1}{40}$th of an inch. The wire gauge, as I dare say is well known to your readers, consists of a plate of steel having notches cut in the edge numbered from 1 to 40, beginning with the largest size. My object in troubling you, is to ascertain, if possible, by what rule these notches are made, as it seems to me that there is no regularity in the sizes of them, and the gauge makers with whom I am acquainted only copy from each other.

By inserting this in your valuable Journal, you will confer a favour on,

Yours very respectfully,

MENSURATOR.

Wolverhampton, June 15, 1841.

### PROPOSITION IN PROJECTION.

Sir,—I am not aware whether the following proposition, or the analytical demonstration which accompanies it, is given in any work upon projection: it has reference to a case of every-day occurrence in mechanical drawing, and is at your service if you think it worthy a place in your Magazine.

I am, Sir, yours very obediently,

WILLIAM POLE.

A. S. C. E., Mem. Math. Soc.

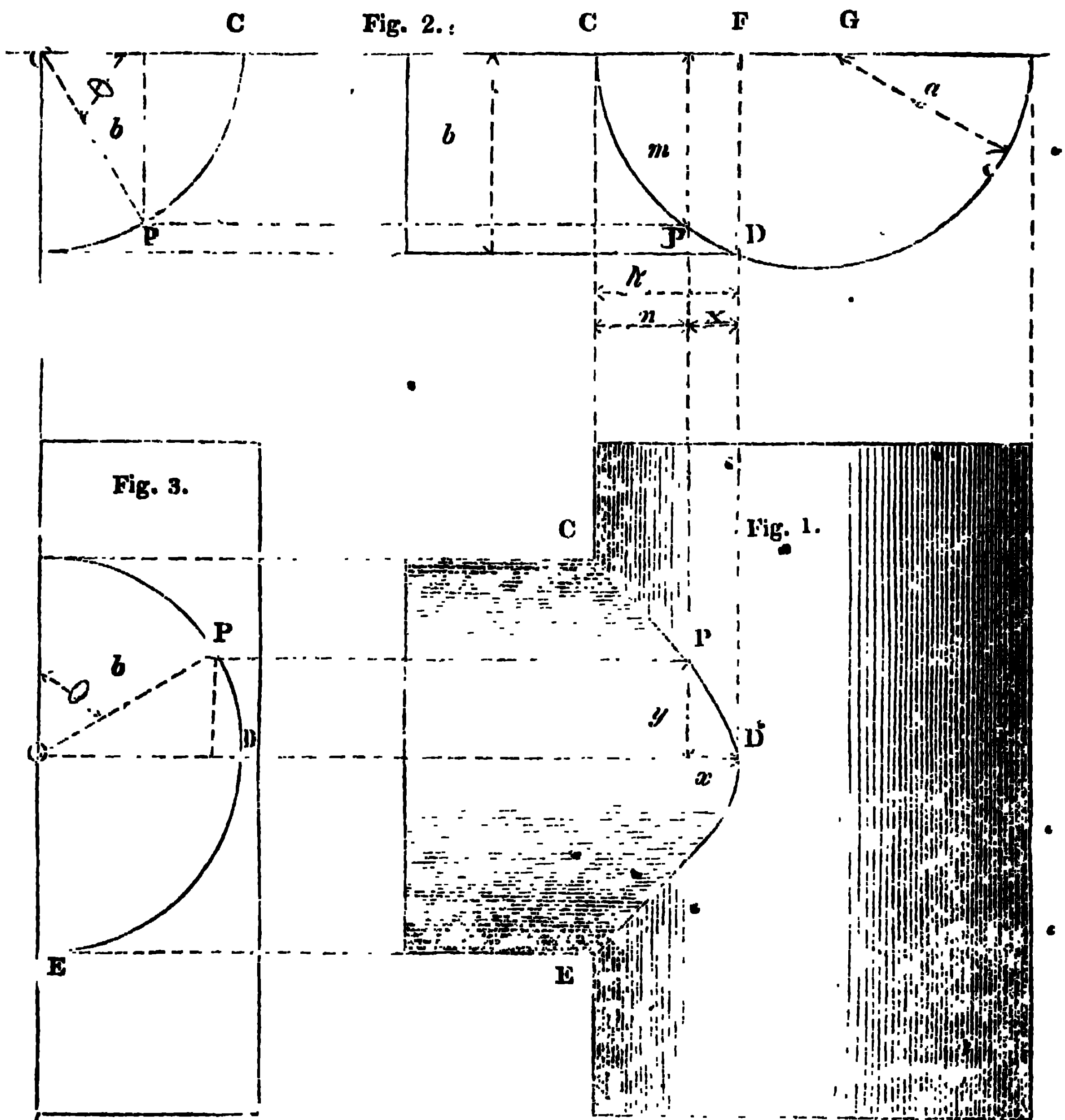
85, Great Russell-street, Bloomsbury, March 2, 1841.

*Proposition.*

In the orthographic projection of a cylinder having another cylinder of

smaller diameter branching from it at right angles, the axes of the two cylinders being in the same plane, and this plane being parallel to the plane of the picture, the line representing the line of intersection of the two cylindrical surfaces will be a *hyperbola.*

Let fig. 1 be an orthographic projection, or geometrical view, of two such cylinders; (a pipe, for example, with a smaller branch upon it, will be a good illustration of the proposition,) then the curve C P D E, will be a hyperbola.




*Demonstration—Analytically.*

Figs. 2 and 3 show the manner of projecting any point P in the curve; let, therefore, $x$ and $y$ be the co-ordinates to this point, whose relations have to be ascertained; let $a$ be the radius of the larger, and $b$ of the smaller cylinder; let also the angle P O C, be called $\theta$. The distances denoted by $h, m, n$, will be sufficiently explained by the figures.

(I.) $y$ is evidently equal to the co-sine of the angle $\theta$, to the radius $b$; or $= b \cos. \theta$, and $y^2 = b^2 \cos.^2 \theta$.

(II.) $h$, the height of the curve, will be (see fig. 2,) the versed sine of an arc, whose radius is $= a$, and sine $= b$.

But any versin = rad. — cos. = rad. $\sqrt{\text{rad.}^2 - \sin.^2}$; whence, $h = a \sqrt{a^2 - b^2}$.

(III.) $n$ (or $h - x$) is also the versed sine of an arc to radius $a$ and sine $m$; or as before, $n = a \dot{-} \sqrt{a^2 - m^2}$.

But $m$ is the sine of the angle $\theta$ to radius $b$ $= b \sin.\theta$;

or $= b\sqrt{1-\cos.^2\theta}$;

or $= \sqrt{b^2 - b^2\cos.^2\theta}$;

or by (I) $= \sqrt{b^2-y^2}$,

and $m^2 = b^2 - y^2$; wherefore,

$n = a - \sqrt{a^2-b^2+y^2}$.

(IV.) Now $n+x=h$; and substituting for $n$ and $h$ in this equation, their values as obtained in (II.) and (III.), we have $a - \sqrt{a^2-b^2+y^2} + x = a - \sqrt{a^2-b^2}$; or, $\sqrt{a^2-b^2+y^2} = x + \sqrt{a^2-b^2}$; or squaring both sides, $a^2-b^2+y^2 = x^2 + 2x\sqrt{a^2-b^2} + a^2-b^2$; whence, $y^2 = 2\sqrt{a^2-b^2}\,x+x^2$.

(V.) The equation of the hyperbola is, $t^2y^2 = c^2(tx+x^2)$; or if the transverse and conjugate axis are equal, $y^2 = tx + x^2$, which is the same thing as the equation resulting from (IV.), proving the curve to be a hyperbola. Q. E. D.

The transverse and conjugate axes being, moreover, equal to each other, and each $= 2\sqrt{a^2-b^2}$; this is twice the length of the line F. G., fig. 2.

As a further proof that the above equation is the correct one for the curve, let $x$ become $= h$; we have then,

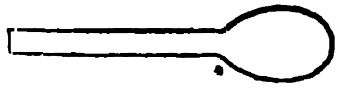
$y^2 = 2\sqrt{a^2-b^2}\,(a-\sqrt{a^2-b^2}) + (a-\sqrt{a^2-b^2})^2$; and by reducing this equation, $y$ is found $= b$, which is evidently the case at that point of the curve.

Again, let the diameter of the branching cylinder be made equal to that of the other; then $a=b$, and F. G. vanishes; whence, $y^2 = 2\sqrt{0}\,x + p^2$, or $y = x$; the hyperbola becoming a triangle, as it ought to be; such, as is well known, being the representation of the line of intersection of the surfaces when the cylinders are of equal diameter.

Perhaps some of your readers may take the trouble of proving the above proposition geometrically.

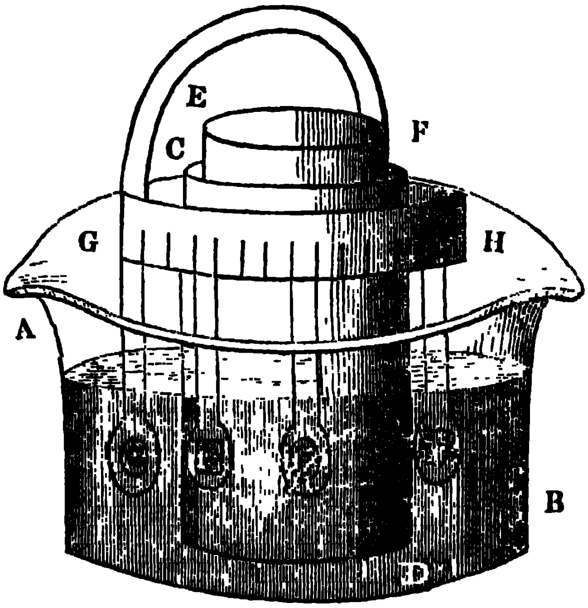
## ELECTROTYPE COPIES OF SEALS.

Sir,—If you think the following method of taking fac-similes of seals by means of the electrotype, worth the attention of your readers, I shall be obliged by your inserting it.

Take a piece of tin plate or copper, cut into this shape, 

the round end being somewhat larger than the seal to be copied. Warm this end slightly, and drop upon it a sufficiency of melted sealing-wax to take an impression. Before impressing the seal, spread upon the wax a piece of gold leaf or Dutch leaf, and if the engraving be not unusually deep, a complete and beautiful impression in gold will be produced.

The other parts of the apparatus require some description.—A B is a common glass finger cup half filled with the solution of sulphate of copper—C D is a very thin cylindrical vessel of wood, containing, among water, a cylinder of zinc, the top of which, E F, is seen attached, by means of a piece of tin plate or copper F G, to the zone G H, composed of the same




material. This zone is notched, for the convenience of attaching to it, by means of solder, the slips of tin plate containing the impressions to be copied. A dozen different varieties of seals may thus be attached at the same time. Before immersing them in the solution, the parts where no deposit is required may be protected by being coated over with a solution of wax or resin in spirits. As the process cannot be accelerated by heat, which would melt and destroy the impressions, three or four days are required to render the cupreous deposit strong enough.

When removed by a penknife, and any adhering wax washed away with a little warm spirits, the copies may be pared and smoothed round the edges with a pair of scissors or a file, and then attached to pieces of metal or wood so as to form seals. If the manipulation be carefully performed they will be equal in sharpness and delicacy to the originals. The gold leaf should be made to overlap the wax to which it is attached, and to adhere to the tin plate round about; but even when it is perfectly insulated, and not in contact with the metal, the deposition goes on, though more slowly.

I am, your obedient servant,

W. FRASER.

8, Drum's Lane, Aberdeen,
May 15, 1841.

### TREGGON AND CO.'S GALVANIC PLANT PROTECTORS.

Sir,—In No. 925 of the *Mechanics' Magazine*, page 342, Treggon's Galvanic Plant Protector is described as made of zinc and copper—the part that is pressed into the earth being zinc, and a ring of copper fitted round it. For the information of your readers, I beg to observe, that the zinc will not last long: being placed in the earth it will soon perish, and the Protector become loose; but if the copper is put into the earth, leaving about 1½ inch above the surface of the ground, with the vandykes, and a band of zinc fitted on outside of the copper, the durability of the Protector will be greatly increased, and its usefulness not the least impaired. Having experienced the rapid decay of zinc under ground for some years, I am induced to make this communication to you to insert, if you think proper, in your useful Magazine.

Yours respectfully,

THOMAS NORTH.

[We readily insert Mr. North's objection, but, even were his theory correct, we are afraid that from the difference in the cost of the two metals in question, the increased durability would hardly compensate for making the largest portion, in lieu of the smallest, of the most expensive material. ED. M. M.]

### QUESTION IN MECHANICAL GEOMETRY.

Sir,—I frequently observe very excellent mathematical productions in your useful Magazine; then, perhaps at your convenience, you will obligingly insert for me the subjoined little question:—

*Question.*—Required the distance a person must travel in winding a cord of 100 yards around a cylinder of 3 feet in diameter, the person walking round with the cord drawn out until he arrives at the cylinder?

It should be solved on the principles of the spiral.

Yours, very obliged,

AMICUS.

May 6, 1841.

### STATEMENT OF THE PERFORMANCE OF THE LOCOMOTIVE ENGINE "HICHENS AND HARRISON," BUILT BY MESSRS. BALDWIN, VAIL AND HUFTY, FOR THE PHILADELPHIA AND READING RAILWAY.

On February 9, 1841, the above engine hauled over the Philadelphia and Reading railway, 54½ miles in length from Reading to its intersection with the Columbia Railway, a train of *one hundred and five* loaded burden cars, laden with 1,318 barrels of flour, 870 kegs, nails, and spikes, 635 bushels of grain, 63 tons of blooms and bar irons, 20 cords wood, 8 casks oil, and sundry other articles of freight, amounting in all to 308½ tons of 2,240 lbs.

Weight of the 105 cars 173 tons, making a total gross weight of 481½ tons of 2,240 lbs., equal to *one million seventy-eight thousand five hundred and sixty pounds* hauled by the engine, not including her own or her tender's weight.

Cars all four-wheeled, wheels three feet diameter, lard and tallow only used in boxes. Whole length of train 1,260 feet (or 60 feet less than one-fourth of a mile.)

Running time 4 hours 54 minutes, making an average speed of $11\frac{1}{10}$th miles an hour.

Total quantity of fuel consumed, 2·51 cords of oak wood.

Total quantity of water evaporated, 1,804 gallons.

Oil used by engine and tender, 7 quarts, including oiling before starting; longest continuous level over which the above train was hauled, $9\frac{1}{10}$th miles. Her speed, with the train on this level, $10\frac{8}{10}$th miles per hour.

Weight of engine empty, 23,250 lbs. With water and fuel 26,710 lbs. Weight on driving-wheels, with water, fuel, and two men, 14,120 lbs. Cylinders, 12½ by 16 inches stroke; driving-wheels 4 feet diameter.

The above road has no *ascending* grade from Reading towards Philadelphia, with the exception of half a mile at its lower termi-

nus or intersection with the Columbia railway, graded at 26½ feet per mile, on which grade the train was stopped.

The profile of the road from Reading to this point is divided into levels varying from 1,600 feet to $9\frac{1}{10}$ miles in length and *descending* grades of from one and a half to 19 feet per mile, the latter being the heaviest grade on the road.

Total length of level line between above points 27 miles and 8-10ths.

Total fall from where the train was started to where it was stopped near the Columbia railway, 214 feet.

Shortest radius of curvature on the road, 819 feet; 1,480 feet of curve struck with this radius.

The engine started the above train on a level without any assistance, and gradually increased her speed to the average rate above stated. She worked with great ease to herself during the whole trip; and hauled the train for the last 14 miles, 10 of which were level, over rails in very bad order, owing to a light snow storm which moistened without wetting their surface, the effects of which, in diminishing the adhesion and power of the engine, practical engineers can well understand and appreciate. The above performance is believed to be unsurpassed; and the train to be the longest and heaviest ever hauled by ONE engine on any railway in Great Britain or America.

G. A. NICHOLLS.
Superintendent Trans. Phila. & Reading, R.R.
Reading, Pa., Feb. 10, 1841.

## ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

*** *Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for the purpose.*

ANTHONY BERNHARD VON RATHEN OF KINGSTON UPON HULL, ENGINEER, *for certain improvements in fire-grates, and in parts connected therewith, for furnaces for heating liquids.*—Petty Bag Office, June 22, 1841.

These improvements consist in so arranging the fire-bars of an ordinary grate that its upper surface is formed into elevations and depressions in its transverse line. This may be effected by making the fire-bars of different lengths, or by making the fire-bars uniform, and their supports uneven. The improvement is shown applied to an ordinary wagon boiler, and beneath the fire-grate formed as above, there is a second grate of the ordinary construction, on which the particles of small-coal that fall from the upper grate are caught and consumed. Between these two grates there is a framing of tubes, the upper parts of which are pierced with a number of small holes; these tubes are supplied with boiling water from the boiler, which evaporating ascends between the bars of the upper grate, and tends to keep them clean. Underneath the second grate there is a third, which receives the ashes, &c., in a state of ignition that fall from those above, while below this grate is the ash-pit, fitted with a door, through which air is admitted into the furnace. By this arrangement the air becomes thoroughly heated before it reaches the upper fire-grate.

At the inner end of the fire-grate an inclined plane rises, and directly above it there is an arch in contact with the boiler, the space between the inclined plane and the arch, which are both composed of fire-bricks, being the passage through which the heat and smoke escape to the flues of the boiler.

A coal-feeding apparatus is described, consisting of two hoppers placed one above the other; the coal is put into the uppermost, from whence it descends through a sliding door into the lower one, and thence into a space in front of the fire-box, where it is dried and warmed, and is then distributed by the stoker over the upper grate by means of a scraper.

JOHN JONES, OF LEEDS, BRUSH MANUFACTURER, *for certain improvements in carding-engines, for carding wool or other fibrous substances.*—Petty Bag Office, June 23, 1841.

From the endless feeding-cloth or apron, the wool is received on to a feeding roller covered with cards, placed at one end of the apron, and is conducted to a part of its periphery by a curved guide; it is then caught by the cards of the main carding cylinder and carried upwards. The lower edge of the curved guide before mentioned, now acts as a detainer to the wool, and the main carding cylinder revolving much faster, and in an opposite direction to the feeding roller, the combs on its surface most effectually separate the fibres of the wool, or other fibrous substances submitted to their action.

RICHARD COLES, OF SOUTHAMPTON, SLATE MERCHANT, *for improvements in making or manufacturing tanks, and other vessels of slate, stone, marble, and other materials, and in fitting and fastening such materials together.*—Petty Bag Office, June 23, 1841.

In the slab intended for the bottom of the tank, an inch from its outer edges, a square groove is formed; in the angles of this groove, about three inches asunder, a number of holes about a quarter of an inch deep are bored. The edges of the side and end slabs are then brought down to a proper thickness, so as exactly to fit into the square groove in

the bottom slab, and along both sides of the edges a square or curved groove is formed. The sides and end being put into their places, these grooves and the small holes are filled with melted lead, or alloy of lead, &c., which, when cold, effectually holds the parts together. The joints are made water-tight with white lead, &c., in the usual manner. Another method of attaching the sides to the bottom slab, consists in forming a dove-tailed groove in each side of the bottom, and cutting the lower edges of the sides to fit, which may then be slid into their places, and the end slabs secured as above directed.

The claim is, 1. To the method of constructing tanks, and other vessels of slate, stone, marble, and other materials, whereby an increased degree of strength is obtained from the more perfect union or connexion of the parts.

2. To the application of molten lead, or other metal in the cavities formed by the holes and grooves above mentioned, for the purpose of effecting such increased degree of strength.

3. To the method of supporting the bottom slab, by means of a dove-tail formed on the lower edge of the side slab, and taking into a corresponding groove made in the bottom slab.

BENJAMIN BAILLIE, OF HENRY STREET, REGENT'S PARK, GLAZIER AND METAL WORKER, *for improvements in locks, and the fixings or fastenings belonging thereto.*—Enrolment Office, June 23, 1841.

These improvements as applied in the first place to rim locks, consist in rounding off all the corners so as to prevent their tearing ladies' dresses, and in attaching the lock to the door by means of an angular stud riveted on its inner side, which slides into a plate staple screwed to the door; the front of the lock being screwed on to the fore edge of the door in the usual manner. The box staple is made with a tenon at the back, which is let into the door frame, and secured by long screws which pass through the front plate of the staple into the door frame and through the tenon.

In the improved lock there is a stop, moved by a small handle on the outside, by turning of which the stop is caused to act against a notch or projection on the toothed sector that works the bolt, and prevents the bolt from being thrown back. For street-door locks this stop has two tongues, which take into the teeth of the pinion that works the bolt, one of the tongues preventing the bolt from being thrown back, the other retaining it when it is thrown back, the tongues being placed so far asunder, that only one can act at a time.

The claim is to the mode of constructing locks and their fixings or fastenings whereby the screws passing through locks and staples are dispensed with. Also the mode of applying a temporary stop to locks as described.

FREDERICK PAYNE MACKELCAN, OF BIRMINGHAM, CIVIL ENGINEER, AND JAMES MURDOCH, OF HACKNEY ROAD, MIDDLESEX, CIVIL ENGINEER, *for certain improvements of, or belonging to, tables, a portion of which is applicable to other articles of furniture,* (partly a communication.)—Enrolment Office, June 23, 1841.

The first part of this invention consists of a bed-table, the upper part of which is supported by a framing at one end which projects forward at the base, nearly to the front of the table, so that the upper part of the table projects over the bed while the base of the framing passes beneath it. This framing is chiefly formed of metal tubes, the upper portion of which slides into the lower, so that the table may be fixed at any required elevation by pins. The requisite strength is given to the framing by truss bracing.

The second part of this invention is a ship table, the top of which is subdivided into pieces, each sufficient to hold a plate or dish; on the under side of these divisions there is a little ball with a stem or rod descending from it at right angles with the plane of the table. The main frame of the table is divided by cross rails into a series of compartments, corresponding in number with the subdivisions of the table top; above the centre of each compartment a small cup is supported by four rods, which cups receive the balls before mentioned, and support the subdivisions of the table, the cups having central apertures through which the stems pass. A second frame, called the governor, is suspended below the first by means of nuts screwed on the four corner stems of the table. The other stems descend through openings in the governor, the four central stems supporting a weighted platform. By means of this arrangement, whenever the floor on which the table is placed assumes an inclined position, the weighted platform will move until the stems by which it is supported are in a perpendicular position, being accompanied by the governor, through which all the other stems pass, and the subdivisions of the table being at right angles thereto, as before stated, will be kept perfectly horizontal.

The third part of the invention consists in various improvements in castors. In the first place the castor consists of an iron screw pin with a conical head working in a conical cup at the junction of the horns; the apex of the cone, which is downwards, is made cylindrical, and receives a small ring through which a pin is passed to keep the cup and horns in their places.

2ndly, The castor is made with two con-

centric sockets, one of which is fixed to the leg of the table, and the second revolves round it, carrying the horns and wheel—the horns and revolving socket being all in one piece. The fixed socket is provided with a pivot, which turns in an oil cup at the bottom of the revolving socket; around the upper edge of the fixed socket there is an annular projection, which just touches the inner circumference of the revolving socket when any lateral pressure is exerted.

3rdly, An iron collar is screwed to the leg of a table, and the socket made in one piece with the horns is put on the leg with its rim under the flange of the collar; a hole is then bored up the table leg, in which a strong screw is inserted, the under side of the head forming the centre of motion of the socket, having a rounded washer over it, inside the socket, to keep the end of the leg from rubbing against the bottom of it.

4thly, Instead of the usual horns of the socket, an axle-block is employed, through which the axle of two running wheels passes; in the upper part of the axle block, a pivot hole is made, in which the conical extremity of a pivot (fastened to the bottom of the socket) works. In front there is a stud, which serves as the axis for an anti-friction roller, which revolves in contact with the under side of the socket.

The fourth head of the invention comprises some improved table fastenings. To one of the leaves of a table, a metallic plate is attached by screws, having a solid piece cast on it of a segmental form; to the other leaf to which it is to be connected, another plate is similarly attached, having a stud which forms the axis or fulcrum of a lever of the second class; the end of the lever through which the stud is inserted, is formed into a square-faced block, with the corners rounded off, and is retained in any position in which it may be placed, by a spring pressing against one of its flat sides. To the under side of the lever near its centre, an anti-friction roller is attached, which rolls against the curved surface of the segmental piece, which being eccentric to the curve described by the lever, brings the leaves of the table together. Several modifications of these fastenings are described and shown.

The claim is, 1. To the bed-table, and its system of bracing, as applicable to other furniture.

2. To the ship-table and its principle of construction as applicable to other ships' furniture.

3. To the construction of castors with the solid conical head, working in a conical cup or socket at the junction of the horns.

4. To the construction of castors in which the socket and horns are united in one solid piece.

5. To the fixed metallic collar.

6. To the application of a pair of running wheels to castors.

7. To the combination of the foregoing with anti-friction roller.

8. To the application of an anti-friction roller to levers of the first or second class, at the point of resistance for table fastenings, whether the roller is mounted upon the moveable or the stationary part.

9. To the same principle of construction of fastening, supposing, that instead of the revolving surface of a roller, a rubbing surface is applied in lieu thereof.

WILLIAM NEWTON, OF CHANCERY-LANE, CIVIL ENGINEER, *for certain improvements in looms for weaving.* (A communication.) Rolls' Chapel Office, July 4, 1841.

These improvements, which are described as the invention of Erastus B. Bigelow, a citizen of the United States, are adapted to the weaving of a variety of figured fabrics, such as are known under the names of Imperial or Paisley counterpanes, imperial French quilts, imperial petticoat robes, and other articles of a similar character; some of which improvements are applicable to looms of other kinds, whether intended for the weaving of figured or of plain goods.

These improvements are described under seven distinct heads, and are as follows:—

Firstly, in the manner in which the shuttles are thrown, the manner of raising and depressing the shuttle-boxes, and the manner in which the picker is relieved from the shuttle. In throwing the shuttle, the two picker staves are made to operate simultaneously, so that the shuttle may be thrown from whichever of the boxes is presented to their action. This is effected by the use of one picker treadle only, which is acted upon by a cam in the usual manner; from this treadle two bands are extended, and pass round the two picker pulleys in such manner, that when the treadle is depressed, both the picker staves will be set in action at the same moment. By this arrangement, two or more shuttles may be successively thrown from the same end of the loom, by the action of one treadle. The shuttle-boxes are raised and lowered in the following manner:—a shaft extends along under the race-beam, from one shuttle-box to the other, and carries pinions which take into racks attached to the shuttle-boxes; by causing this shaft to revolve, the shuttle-boxes may be raised. The revolving of the shaft is effected by a spiral or other spring, one end of which is attached to the frame of the loom, and extends forward towards the lathe; from this forward end a band attached to it passes over guide-pulleys, and round a pulley on the above-named shaft, to the latter of which it is attached. The action of the spring, by its drawing upon the band,

will cause the pinion shaft to revolve, and will consequently raise the shuttle-boxes. Should the spring be thrown out of action, and the band by which the shuttle-boxes are raised be relaxed, they will descend by their own gravity. To take off the tension of the spring, there is a cam upon the main shaft of the loom, which cam, as the shaft revolves, depresses a treadle, to the end of which a band is attached, that relieves the shuttle-boxes from the action of the spring, and they then descend. In relieving the picker from the point of the shuttle, the ordinary protection rod is employed: from this rod, which extends along below the shuttle-boxes, a small arm or finger descends, which finger, as the lathe comes up towards the breast-beam, strikes against a stop attached to the loom frame, and causes the protection-rod to revolve a short distance: this gives motion to two arms which project from the extreme ends of the protection-rod, opposite to the outer ends of the two shuttle-boxes; from these arms motion is communicated to a lever, which works on a fulcrum over the outer ends of each of the shuttle-boxes, the said arms being connected to the lever by rods or wires. By depressing the outer ends of these levers their inner ends are raised, to which are appended rods carrying pieces of wood or metal, which when down rest on and embrace the picker rod, and in that position they serve to hold the picker at a short distance from the end of the shuttle-box, and to stop the shuttle; the picker is then removed from the point of the shuttle by the raising of the lever, the picker being made to pass home to the end of the box, thus leaving the shuttle and shuttle-box free to be raised or lowered without obstruction; the picker being also ready again to act on a shuttle.

Secondly, an improved manner of arranging the toothed gearing, so as to obtain the power necessary to lift the weights which are suspended from the harness of looms intended for figured weaving; in the arrangement of the parts concerned in stopping of the loom; and in an apparatus for counteracting the momentum when the loom is thrown out of gear, for changing the spools, &c.

On the main shaft, furnished with a fast and loose pulley, there is a small driving-wheel of 32 teeth, which gears into a wheel of 150 teeth on a second shaft, which also carries a wheel of 50, driving another of 150, on a cam-shaft, which drives a wheel on the crank-shaft that works the lathe. These numbers show the relative proportions of the wheels, which, however, can be varied according to the power required.

For stopping the loom, a bayonet on the protection-rod comes into contact with a rotating shaft, and causes it to turn sufficiently far to allow the bayonet to pass the projecting piece freely, and thus to obviate the injury which would be likely to occur by the sudden arresting of the lathe when under the full momentum of the machine, as is the case in the ordinary loom. A cam at the end of a shaft liberates the shipper spring, and shifts the band in the ordinary way. A spiral spring is attached to the shaft and to the breast-beam, in such a manner as to cause the shaft to resume its proper position when left free to do so. The additional apparatus for suddenly arresting the motion of the loom when the shuttle is in the warp, and consequently does not enter the shuttle-box, consists of a sliding shaft forced forward by a spiral spring, and held back by a stop piece made fast upon a shaft, the said stop piece bearing against a shoulder, and when the shaft vibrates a sliding rod is relieved, and carried forward to the requisite distance for causing the vertical shaft to rotate to a short distance; this shaft is connected with the sliding shaft by an arm and pin. The rotation of the shaft causes it to draw in a stop lever, which stops the machine.

For counteracting the momentum of the loom when thrown out of gear, a friction band passes over a friction pulley, one end being made fast to the frame of the loom, the other to a lever or treadle. When this lever is supported, the pulley is free to revolve; but when the lever is depressed, a powerful resistance is exerted upon the pulley. This lever is connected to an elbow lever, and when the shipper spring is held in, it keeps the lever elevated; but when the said spring is liberated, the lever falls, and produces the required friction on the pulley.

Thirdly, Improvements in mounting and tying up the harness, and of working the same by a combination of cams and treadles, so as to produce the fabric commonly known by the name of Paisley, or Imperial counterpanes, and others analogous in character.

A Jacquard machine, similar to that in ordinary use, rests upon the floor of the mill above the loom; the knot cords are tied to the neck of the harness, and pass down through the heck frame, and are tied to the male cords by a knot of sufficient size to enable the journal or harness-board, when it rises, to lift the male cords and the suspended weights. The harness-board is perforated with smooth holes, which allow the male cords to pass freely through them, and has a vertical reciprocating motion upon guide rods. The working of this mounting or harness requires three principal motions; the first motion is that of depressing it, which is effected as follows:—a cam acts on a treadle during the introduction of one thread of filling or woof, and through the medium of a rod, works a vibrating lever, and thereby turns a shaft,

which elevates the arms of a lever and the harness connected therewith by cords. When the first cam begins to be relieved from its action, two other cams begin to act on another set of treadles, and depress the harness. The second motion consists in raising and depressing the journal or harness-board by means of a similar arrangement of cams and levers. The third motion for working the Jacquard machine is also similarly effected. To weave the fabric in question, one-half of the chain or warp is drawn through the front harness, the other half through the Jacquard harness; and the motions are performed in the following order:—The front harness is raised, and a shot of fine filling is introduced, then, while the said harness is sinking, both the journal or harness-board, and the trap-board in the Jacquard machine are raised simultaneously, and a second thread of fine filling is introduced. The journal or harness-board then descends with all these threads in this shed of the warp where the filling is to be raised to form the figure, while the trap-board remains holding up those warp threads where plain cloth is required; a coarse thread of filling is now introduced, and the trap-board then descends, and the harness rises as before.

Fourthly, Certain other improvements in the manner of mounting the loom, tying up the harness, and working the same. The Jacquard machine is supported as before stated; the knot cords being tied to the neck of the harness, pass down through the beck frame and through the journal or harness-board, which is here stationary, and are connected to the males, to which weights are suspended in the ordinary way. The stationary harness-board is perforated as before described, and is supported at its ends by standards bolted to the end-frame-work of the loom. In working this mounting and harness, three principal motions are concerned; the first is that of raising the leaf of heddles; secondly, in depressing the same; and, thirdly, in working the Jacquard machine, by an arrangement of cams and levers. When the machine is duly prepared for working, the harness or leaf of heddles is raised, and a thread of fine filling thrown through; it then descends, and at the same time the harness and the trap-board of the Jacquard machine are raised simultaneously. The trap-board takes up all these threads in the warp, which are drawn through the male in the Jacquard harness where plain cloth is required, whilst the remainder of the warp threads, that is those over which the coarse filling floats to form the figure, and which are not raised by the trap-board, are raised by the leaf of heddles; another thread of fine filling is now introduced, and the leaf of heddles descends; a coarse shot of filling is then introduced, and the trap-board descends while the leaf of harness rises as before, and the same routine is repeated.

Fifthly. Certain other improvements in the mode of mounting the loom, of tyeing up the harness and working the same, so as to adapt it to the weaving of figured fabrics with a loose back, commonly known by the names of Imperial or French quilts, Imperial Petticoat Robes, and other articles of an analogous character.

The loom and harness being duly arranged, as described, three principal motions are required in operating therewith, so as to produce the fabrics enumerated; the first is, working the Jacquard machine; the second and third motions are applied to working the leaves of heddles. In preparing the loom to work the fabric in question, two kinds of warp are usually employed, and that part of it which is to form the face of the cloth is drawn into the heddles in the same way in which the warp is drawn into the harness of the ordinary loom for weaving plain cloth; and that portion of the warp which is to form the back of the cloth is drawn through the Jacquard harness, in two equal sheds. In working the mounting and harness in this loom, the motions take place in the following order. First, the leaf of heddles or harness is depressed, and the trap-board of the Jacquard machine is raised at the same time, and a thread of fine filling is then introduced; the first leaf of harness is then made to rise and another to descend, and another thread of fine filling thrown in, the leaf then rises, and a thread of coarse filling is introduced; the trap-board descends, and rises again, while the leaf of heddles is sunk as before.

Sixthly. Improvements in the loom for weaving with a smooth back such figured fabrics as are commonly known under the names of Imperial or French Quilts, and Petticoat Robes. The construction of the loom is described at length: the polygon or prism which carries the pattern-card of the Jacquard machine is peculiar in its construction, and is described in a patent previously granted to Miles Berry, Nov. 27, 1840. In this arrangement six principal motions are concerned in working the harness and its appendages, viz.: 1. The motion of the first trap-board; 2. The motion of the second trap-board; 3. Working the first journal or harness board; 4. Working the second journal or harness board; 5 and 6 consist of those by which the heddles or harness are worked. The warp is usually of two kinds; that which is to form the face is drawn through the leaves of heddles, in the same way as a web is drawn into the harness of a common loom for weaving plain cloth. The other part of the warp, which forms the back of the cloth, is drawn half through each of

the males connected with the cords passing through the two journals.

Seventhly. Improvements in the manner of strengthening the lathe and back girth of of the loom over which the yarn passes, so as to adapt it to the weaving of fabrics of great width and fineness; and also in the manner of delivering out the chain or warp, and of taking up the finished cloth in such a manner as to insure evenness thereto, and to put a given number of threads of filling in an inch, or other determined space.

The breast beam and top back girth are strengthened by means of cross braces extending across the loom, from the breast beam to the top back girth, at suitable distances from each other, and from the end of the loom. The lathe is strengthened by gearing it at both ends of the loom, and by employing four swords and four lathe cranks. In delivering out the chain, &c., the warp passes from the yarn beam over the top back girth, through the harness and reed, then over the breast beam down to, and is wound on to the cloth roller, which winds up the cloth by means of a lever click and ratchet, in the ordinary way. In order to regulate the number of threads in any given space, there are a series of levers and ratchet wheels so arranged, that when the lathe moves forward to beat up the cloth, the ratchet wheel is moved one tooth for every thread of filling. There is also an endless screw, or wormwheel, affixed to the periphery of a measuring roller, which is so regulated as to pass over as much space, every thread of filling introduced, as the said filling is intended to occupy. Various modifications of all these arrangements are shown. The foregoing is a very brief abstract of this voluminous specification, which in the original occupies fourteen skins of parchment, and is accompanied by nine sheets of explanatory drawings.



## MINE VENTILATOR.

Among recent applications of mechanical powers of the simpler class, we notice with considerable pleasure that of a machine for ventilating mines, and for displacing stagnant air from any position where other means may have failed to afford a necessary supply of the purer element.

The machine to which we allude is an eccentric fan with four or more vanes, contained within a strong coating of iron, in connexion with wheel-work, by which it is made to revolve with great rapidity. For mine work, the machine is attached to the projecting end of a tube carried to any given depth, and the unfailing effect of its action is a displacing of the impure air, and a substitution of that which is requisite to sustain life. It is equally effective for ventilating ship's holds, and buildings where large assemblies are collected, securing in either case a constant supply of fresh air. We know many instances where the adaptation of these simple machines would preserve life, and can enumerate others where they would afford indemnity against the inconvenience and unhealthiness of a high temperature and tainted atmosphere.

Most of our readers will remember the almost enthusiastic praise bestowed upon that eminent philosopher and chemist, Sir Humphrey Davy, for having successfully devoted his attention to a means of protection against the explosion of fire damp in mines. But the safety lamp, however perfect in itself, needs also careful management in the mines; any attempt to open the lamp in localities charged with an excess of hydrogen being instantly fatal to all within reach of the ignited gas. The air extractor, on the contrary, effects the double purpose of immediately ridding the mine of noxious air, independently of attention on the part of the workman, and of obviating the stoppage of works which, on this account, so frequently occurs in mine districts.

In confirmation of the practical usefulness of the machine, we have lately been shown a letter from a gentleman who superintends the works of Tamar silver lead mines, Cornwall, where one of them, made by Mr. Nicholson, C. E., of the Panclibanon, Baker-street, London, was applied to extract the foul air from a depth of 115 fathoms, with an additional 100 fathoms of level, which it performed with surprising quickness and effect. This result, together with the very cheap rate at which it can be supplied, has brought it into extensive demand; and we have no doubt the mere sense of duty, upon the question of humanity towards workmen in situations exposed to danger from foul air, exclusive of other and important advantages, will induce inquiry, on the part of proprietors of mines and others, into the validity of information which we are gratified in being among the first to communicate.—*Post Magazine.*

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# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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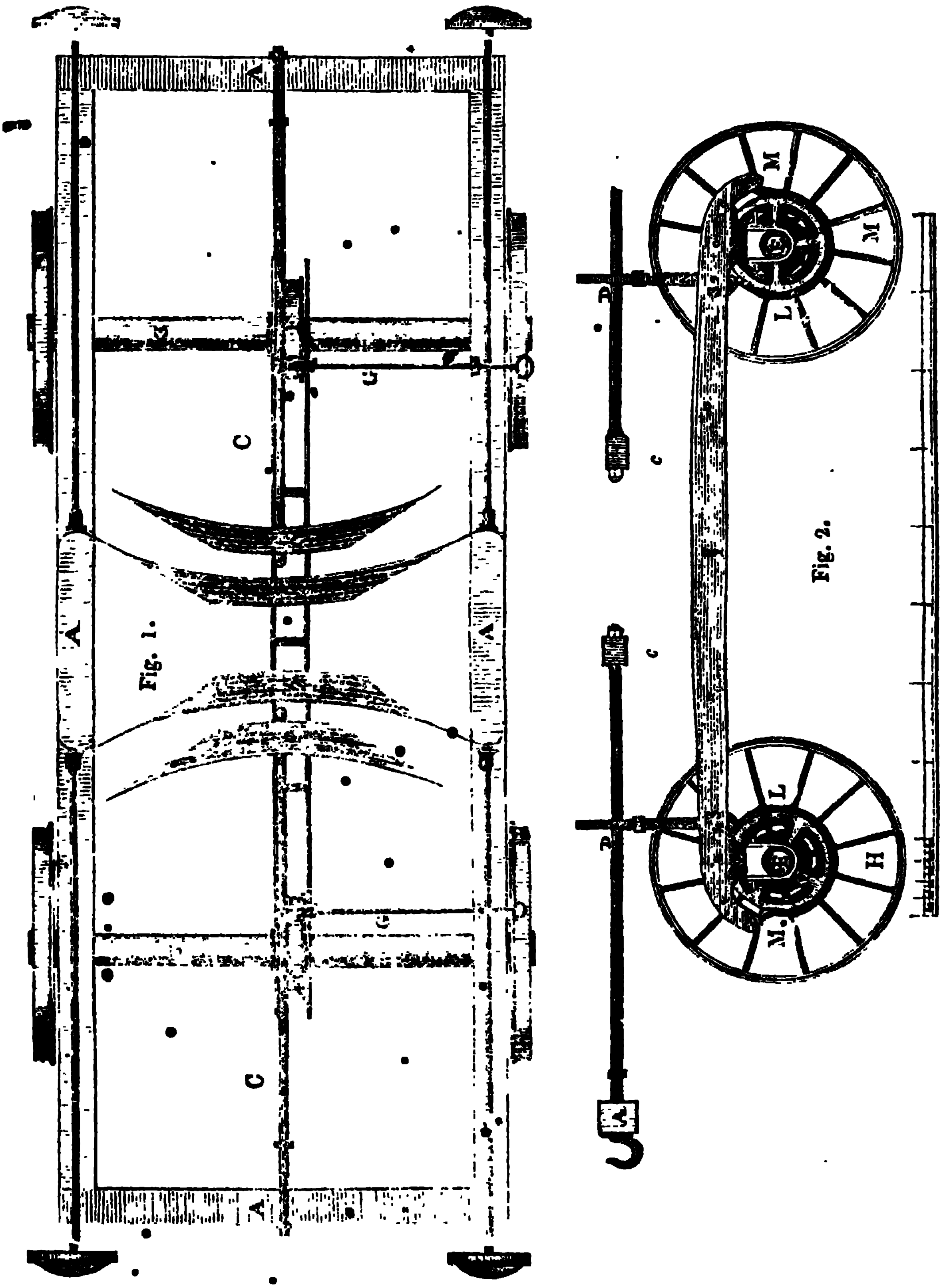
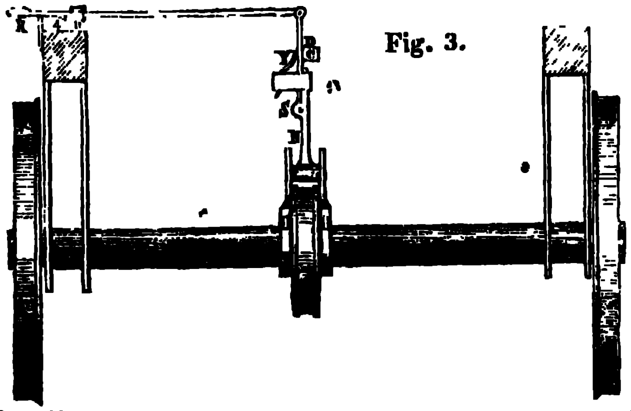
## MONTGOMERY'S SELF-ACTING BREAK FOR RAILWAY CARRIAGES.



## MONTGOMERY'S SELF-ACTING BREAK FOR RAILWAY CARRIAGES.

Fig. 3.



The attention of railway mechanists is at present much employed in devising means for the prevention of accidents. Among the contrivances designed for this purpose, self-acting breaks occupy a prominent place. An invention of this kind, by Mr. Robert Montgomery, of Johnstone, deserves the attention of railway engineers.

The general principle of this break, like most others of this kind is, that as soon as one carriage ceases to pull the carriage attached to it, the break begins to act; and if a break is attached to each carriage it will come into action as the pull of the preceding carriage ceases—and thus the whole train will be almost instantly stopped when the steam is cut off from the engine. When the engine is again set in motion the pull will release each of the carriages in succession from the action of the breaks.

The accompanying engravings and explanation will, it is hoped, make the plan easily understood.

Fig. 1, on our front page, is a ground plan of the carriage; A A, the wood framing; B B, the buffers, and *b b*, the buffer springs; C C are coupling bars, and *c c* their springs. D D are notches or checks on the coupling bars; E E, the axles; F F, friction wheels, and G G, rods for connecting or disconnecting the drags.

Fig. 2 is a side elevation. H H are the carriage wheels; I I, iron framing supported on the axles E. L L, are steel friction straps fixed to the iron framing I, by a bolt at M; N, friction lever attached by the joint 2 to the steel strap L, and by a joint at 3 to the iron framing I. D D are notches or checks on the coupling-bars to act on the friction lever N, when the coupling bar is drawn out so as to release the stop L from its hold of the friction wheel F, and to act on the lever N, so as to bring the break into action by the spring C, drawing back the coupling-bars, when released from the pull of the engine. As the front breaks only are to be in action, the rod G (see fig. 1) is for the purpose of drawing the lever N out of the notch D, by the handle R.

Fig. 3 is an end view of the carriage, showing a joint on the friction lever N at S, to allow the lever to draw out of the notch D, by the rod G, which is kept out by a catch 4. To put the break into action, the rod G is to be raised by the hand out of the catch 4, and by means of the spring Y, the lever N is thrown into the notch D on the coupling bar C.

## PROPOSED CULTIVATION OF THE DUTCH SPECIES OF RUSHES IN ENGLAND, &c.

Sir,—From the severe winter of 1794, when General Pichegru made his successful irruption into Holland, over the ice, that country became suddenly loosened in its bonds of commercial intercourse with ours, and fell immediately into the grasp of the then dominant republican France. Perhaps two more opposite people could not be brought into a state of national assimilation, than the cool plodding Dutchman and the versatile playful Frenchman—the one all slowness and deliberation; the other all fickleness, speculation and hurry: certain it is, that the Hollanders, since they sunk under the vassal-

age of "the tri-coloured cockade," have never recovered, to this day, (and probably never will,) that national weight and importance which they had previously possessed under the jurisdiction of their old form of government. Slow in their movements, industrious to a degree not to be surpassed, and indefatigable calculators in making a bargain, this original and truly singular people, in spite of a soil, a great portion of which is artificially gained from the sands of the sea-coast, and labouring under a climate at once foggy and piercingly severe in winter, they have continued to rear in profusion every species of natural production necessary for their own support, and likewise to export a considerable surplus to our markets, and others that may be in want of them. I will now come to the main purport of this letter, which is, to observe, that during the non-commercial intercourse between Holland and Great Britain, which lasted a number of years, a great scarcity existed in an article which we had been in the habit of importing largely in time of peace; and which article is essentially necessary to the efficient employment of more than one branch of our manufacturing industry. I allude to that of Dutch rushes, which were not to be had during the war, except in very precarious chance lots, occasionally smuggled over, *at any price;* and the chair-makers of Chipping, Wycomb, Stoke Church, and other places, principally in the county of Buckingham, where the chair-making business is extensively carried on, were at a complete stand-still for want of the usual supply, as well as were the manufacturers of hassocks, market-baskets, and mattings of various sorts, made from this production of nature. This species of commercial scarcity continued, with little variation, till that grand epoch which awakened Dutch lethargy from its trance, the unfurling of the "Orange Boven" flag. From that time to this, Dutch rushes have come over to this country with sufficient regularity, and I believe in sufficient quantity, to satisfy our demands; but England's dependence upon a foreign market for the supply of this useful article, which I think she might grow at home, still exists, and, in case of another transition from peace to war, we shall be liable to suffer the same privations as heretofore; to prevent which, my proposal is, to recommend the growth of the Dutch species of rushes in this country, such as are used by the trades I have specified, so as to render us independent of Holland for a supply in future. Surely some part of our island possesses a sufficient congeniality of temperature and soil to effect so desirable a purpose. Scotland, and *the county of Lancaster, which grows our best smaller rushes, such as are used by candle-makers, might be perhaps tried with success;* or Lincolnshire, renowned for its fens and stagnant waters, might probably suit for an experimental plantation. In the mean time, I shall be glad if any of your correspondents, who are conversant with the growth of Dutch rushes, would be kind enough to furnish your readers, and the country at large, with some useful information upon a subject I have, from the best motives, thus brought forward.

I remain, Sir,
Your most obedient servant,
ENORT SMITH.

### THEORY OF HEAT.

Sir.—Your correspondent A. Y. from the tenor of his letter inserted in No. 921, p. 266, of your work, appears to be a little nettled because I presumed to congratulate myself on the obtainment of his valuable corroborative testimony in aid of the evidence I had advanced in support of the theory relative to heat; but why he should feel angry because I pointed out the assistance which he had rendered me, and for which I presented him with my best thanks, I have yet to discover. As for the use of vaunting language, instead of wrestling with the subject, I am not conscious of having resorted to it, and conceiving that I had no opposing subject or opponent to wrestle with, and perceiving that A. Y. proved to be a controversial auxiliary rather than a competitor, it would have been folly to have attempted to wrestle with a shadow, and ungenerous to contend with a friend; therefore I considered it more decorous to express my pleasurable satisfaction on the re-

ceipt of his assistance, and to point out how ably he had demonstrated it, although he had entered into the lists of discussion as a voluntary opponent.

The subject in dispute originating between Mr. Prater and myself was, "The cause of the ebullition of water in the air-exhausted receiver of an air-pump." Mr. Prater attributed the effect to a particular cause—the inherent activity of the atoms of matter—and I attributed the effect in the first instance, I grant, to the mechanical force exerted by atoms of heat permeating the glass receiver in obedience to the law of equal diffusion, to which I conceive they are subject, for the purpose of occupying the space from which the air was withdrawn, and which pressing upon the surface of the water, occasioned the agitation of its surface, producing the effect termed ebullition. But in my reply to A. Y. inserted in No. 911, p. 54, I referred him for a fuller and corrected opinion on the subject, to my reply to Mr. Prater, as the following extract, and enclosed in parentheses, will show. ("For a fuller exposition of my opinion, and somewhat corrected, on this subject, I beg to refer to my reply to Mr. Prater inserted in No. 898, p. 403.") And having so referred him, I conceive that he was in justice bound to confine his observations or criticisms to the latter exposition instead of the former, but for some motive best known to himself, he has preferred to furnish his comments on the former instead of the latter. The following passage containing that exposition more fully and clearly will be found at nearly the end of p. 407.

"And it should be remembered, that in exhausting the receiver of the air within, a large amount of latent heat, forming a constituent of the air, is also withdrawn, and which, being constituent, and inseparable from the constituent ponderable atoms, other than by pressure or by abstraction, in obedience to the law of equal diffusion, must therefore be withdrawn simultaneously. This abstraction, then, of the latent heat of the air from within the receiver must necessarily cause the thermometric heat of the water to pass into the space above, to replace the latent heat abstracted; and by its transition a portion of the ponderable atoms of the water will be elevated with it, and together constitute the vapour which is seen to rise; and consequently the thermometric temperature of the water will be diminished, and indicated by a corresponding effect on the mercury in the tube of the thermometer; but this reduction in the thermometric temperature of the interior of the receiver, and the solid or fluid substances within, would, I apprehend, be but temporary, because by such reduction for the purpose of furnishing a quota of the requisite latent heat to fill up the space previously occupied by air, the temperature of such water or other substance would be reduced below the temperature of the external media; and such being the case, a transition of heat from such external media to the water or other substance within would soon restore it to an equal temperature."

Now A. Y. ascribes the ebullition of the water to the formation of vapour, and its violent liberation when the pressure of the atmosphere is taken off; and herein it will be perceived that we quite agree in opinion, that on the abstraction of the air from the receiver there is a formation and liberation of vapour, and as there cannot be the creation of vapour without the impartation and diffusion of heat, there must be a motive force to cause that impartation and diffusion; and as there cannot be the liberation of vapour from the surface of water without the occupation of space by that vapour, so therefore, as the vapour which A. Y. says is formed and violently liberated from the water cannot occupy any other space, agreeable to its specific gravity, than the space pre-occupied by the air withdrawn, so during the existence of such vapour there cannot be a vacuum within the receiver. But A. Y. will perhaps say, that although there can be no vacuum in the space above the water while the vapour exists, yet there may and will be as soon as the vapour which has been generated is condensed. But what is to condense that vapour since, according to A. Y.'s declaration, the space above the water is a vacuum? Can the exterior atmosphere exert a force or power upon that vapour which I suppose A. Y. would have us to imagine exists in a portion only of the space pre-occupied by air, enclosing the nucleus—water; and can the exterior atmosphere also diminish the temperature of such water, (which A. Y. admits is diminished,) by the exertion of some unknown force or power making its way through the vacant

space until it arrives at both vapour and water, and then retracing its piratical footsteps, loaded with the booty of thermometric heat, passes from the dense fluid through the flimsy shrouding vapour, annihilating it in its course, and having nothing to oppose its progress in the vacant space beyond, finds easy egress through the vitreous portals, and wings its way, a faithful forager, unto its native element, the atmosphere. But A. Y. appears to have an abhorrence of any thing that is imaginary, and therefore I will not vex him more, but leave him to explain, at his leisure, how and in what way vapour and vacuum are to co-exist in the air-vacated space; and how he will condense and utterly destroy his vapour; and how and in what way he will transport a portion of that superfluous heat from the receiver, which he states must be admitted with the water, in order to produce the effect of ebullition; and as he disputes and denies the correctness of my way of accounting, he is doubtless prepared more fully, explicitly, and satisfactorily to show his own. But I cannot quit the subject yet; for I find that A. Y., with all his hatred of imaginary forces, appears to have conjured up one that is as baseless as his perception of its properties: I mean the elastic force of heat, which, in the following passage of his letter, he states to be the cause of the formation of the vapour, its violent liberation, and, *ergo*, the ebullition of the water. "And when the pressure of the atmosphere is taken off (the water,) it (the vapour and its violent liberation) arises from the *elastic force* of the superfluous caloric contained in the water itself." Now, this force appears to me to be as much like an imaginary force, as two peas resemble each other. The elastic force of heat! Well, let us see what we can make of it. I can comprehend the meaning of the term elastic, as applied to a piece of sponge, which may be reduced in bulk by pressure, and which on the removal of such pressure will resume its natural bulk; and I can also comprehend the meaning of the term elastic, as applied to caoutchouc, (India rubber,) which may be distended by mechanical power, and which, on the removal of the force employed, will contract and be diminished to its original volume; but as to the elastic force of heat, I really cannot comprehend its force or properties. But A. Y. has furnished us with an exemplification, by reference to an experiment with a pulse-glass, and we cannot do less than do him the justice to examine it.

And, as some of your future readers may not have read A. Y.'s letter, I will furnish them with an extract of such exemplification. "A common pulse-glass will verify the correctness of what I have advanced (the effects resulting from the exertion of the *elastic force* of heat.) This is a sealed glass tube, from which the air has been extracted, and contains a small quantity of water. Here, then, are the conditions of the experiment realised—water in a vacuum. Apply the warm hand to the bulb containing the water; remembering that the hand is at a temperature considerably above that which is necessary for the ebullition of water in vacuo, and that the external air, in its ordinary state, is considerably below that point. The water thus raised to its boiling point, by a supply of caloric conducted from the hand, commences to throw off vapour, which, in its violent escape, causes the commotion which has been commented upon, as long as the supply of heat is kept up; and this will continue, providing the extreme end of the glass tube is preserved sufficiently cool to condense the vapour as fast as it is produced."

Now, let us investigate the properties of this *elastic force* of heat, which A. Y. says produces these effects. If we are to judge of causes by the effects produced, the properties of this elastic force, discovered and made manifest by A. Y., must be a compound of the two forces which are exerted to cause the two substances mentioned—sponge and caoutchouc—to resume their natural bulk, on the removal of the superior restraining force, namely, the expansive and the contractive; and if it is the momentum of this expansive elastic force which strikes the bulb on its exterior, and the amount of which is transmitted to the water within, and causes it to recede from the bulb to the tube, which, being vacant, presents no impediment to its progress, so its return from the tube to the bulb must imply a

limit to the exertion of such force, and if the recession occurred but once, it would not be necessary that there should be the exercise of a contractile force, inasmuch as the water would return to the bulb by the power of gravity; but as A. Y. shows that there may be a continuance of the effect on certain conditions, so must it necessarily follow, that the exertion of a contractile force must precede the exercise of a renewed expansive force, and its further continuance imply an alternate exertion of this expansive and contractile force. Having thus far rendered A. Y. my best assistance, in explaining the operation of this his newly-discovered force, and which he has neglected to do himself, and having so done upon the only explicable grounds that I can see it possible to accomplish it, I find a few questions intruding on my thoughts, and which it appears to me to be necessary that I should submit to A. Y., and to which he will perhaps furnish a ready and satisfactory reply. Why is it necessary that the temperature of the hand should be considerably above that which is necessary for the ebullition of water in vacuo? For if the elastic force of heat is the cause of the commotion commented upon, and not the impartive force resulting from the operation of the law of equal diffusion, on what principle is its elasticity increased, on the increase of temperature of the hand? If this elastic power of heat causes the recession of the water from the bulb to the tube, as the effect of the momentive force of such heat on the exterior surface of the glass bulb, and does not permeate its atomic interstices, how is it that the water attains to the temperature of ebullition without the impartation of any heat from the hand, and its admixture with the water in the bulb? Does it accomplish it sympathetically? If the water within is raised to the boiling point without the impartation to, and the admixture of heat therewith, in what way is the creation of vapour effected? Is that created, too, by the force of sympathy? If vapour is created in the water, and violently liberated therefrom, does it occupy the space which is said to be a vacuum? And if it does occupy such space, can it be truly said that such space is vacant, and then can it be properly said that there is water in a vacuum? If the heat of the hand cannot permeate the glass bulb, why is it a necessary condition to the continuance of this commotion, that the supply of heat should be kept up, since if there is no impartation there can be no loss, and if no loss there can be no need of a fresh supply. If no heat permeates the glass bulb, and consequently none mixes with the water, and if the vapour created is effected without the impartation of heat, why is it necessary that the extreme end of the glass tube should be preserved sufficiently cool? Now, if the *modus operandi* had been left for me to explain in my simple way, I should have stated, that the pulse-glass was filled with water and latent heat, and such heat I would denominate, while there, the constituent heat of air-vacated space. I should then have endeavoured to show, that the thermometric heat of the hand being greater than the thermometric heat of the water, a transition of heat from the former to the latter was effected, as induced by the law of equal diffusion. The supply of heat to the hand being continuous, resulting from the circulation of the blood, the transition of heat from the hand to the water must also be continuous, until the temperature of the latter is raised to that of the former.

The space within the pulse-glass unoccupied by water, and freed from atmospheric air, being devoid of ponderable atoms, was free to admit the ponderable atoms of water, either in a state of close proximity, as they are usually posited while the water is in that condition termed fluid, or more remotely separated from the parent mass in that condition called vapour. Such space being free, then, for the occupation of vapour, nothing more was requisite for the formation of vapour than the impartation of a sufficient amount of heat from the hand to the water, to separate and diffuse throughout the air-vacated space a portion of its ponderable atoms. In proportion to the difference between the amount of heat in the hand and in the water, would be the force of transit of heat from the former to the latter, the rapidity and force of transit being by the law of equal diffusion, proportionate to the inequality in the amount of thermometric (not latent) heat pos-

sessed by two contiguous or adjoining bodies.

The heat of the hand being considerably above the temperature of ebullition of water in an air-vacated space, and the water within the pulse-glass, the rapidity and force of transit of the heat from the one to the other to cause the violent extrication of the created vapour, and consequently, the commotion of the water, is evidenced. But for the continuance of this commotion, it is requisite that there should be a continuation of the transmission of heat from the hand, of the creation of vapour, of its violent extrication from the water, and its diffusion throughout the air-vacated space; and as that space is already filled without vapour, how are we to cause it to be emptied of that vapour so as to allow of the creation and violent extrication of more? Why, we must do, as A. Y. says is necessary to be done; we must take care that the external media in immediate contact with the tube of the pulse glass, to be sufficiently low in temperature to admit of the transition of the thermometric heat of that vapour to such external media, and the constituent ponderable atoms of such vapour being no longer diffused throughout the air-vacated space by the imparted heat, fall by the force of gravity to their original source, again and again to be diffused by the accession of continous supplies of heat. But the inquiry may be made, what have I done with the latent or constituent heat of air-vacated space that occupied the pulse glass previous to the commencement of the experiment? The reply to this is, that its exudation from the pulse glass through its atomic interstices was effected by the thermometric heat and ponderable atoms of the vapour with which it was subsequently filled, and upon the condensation of which an equal amount of latent heat is left to fill such air-vacated space. But the questions which I have put to A. Y., he will doubtless be able to answer to his own satisfaction, if not to that of your readers, and when he has so done, and explained his theory of the elastic power of heat, better than I can do, it will be for your readers, and not us, to judge whose opinions approximate the nearest to correctness.

As the theory of the law of equal diffusion of heat which I advocate, cannot imply the possibility of a transfer of it from a body containing a minor quantity to one that contains a greater; as I am not aware that I have in any way endeavoured to inculcate such an opinion, but on the contrary, have endeavoured to prove the very reverse; and as my views, I think, have been clearly and explicitly stated, and that it must appear evident to every candid inquirer, that I consider that what is usually termed the thermometric heat of a body is first transferable, and then a portion or the whole of the constituent or latent heat, provided any substance can be placed in contact or proximity sufficiently low in temperature, as is evidenced in the conversion of water into ice, when not only its thermometric heat, but also a large amount of its constituent latent heat is also abstracted; so therefore do I consider the observations made by A. Y. relative to what migt be the expectations of the proprietors of steam generators, not only superfluous, but quite irrelevant to the subject, and furnished either for want of a comprehension of my views, or from some less excusable cause.

A. Y. next states, "When vapour rises from water in an exhausted receiver, it will be accompanied by its equivalent amount of sensible heat, and its store of insensible or latent heat." And here he gives me all I ask for a proof of the transition of heat from the greater to the lesser heat-possessing medium, and having conceded the fact, I can see no other reason than his need of right perception in this case, why he should not also concede the mode by which it is effected, or rather the cause which I conceive produces the effect; for if the space above the water is really a vacuum previous to the transference of such heat, he surely will admit that the transfer is from the greatest heat-possessing medium, to that which possesses the least, agreeable to my views, and to none, agreeable to his. And if he will not concede me the cause which I point out, what cause will he substitute for it?

The next observation of A. Y. that requires attention is contained in the following extract from his last letter.

"But the gist of Mr. Wigney's argument seems to rest on his law of equal diffusion" of heat. In fact this, and the law of recession from the centre of the earth, "are the principal novelties which he has presented to our attention." To furnish a testimony of the value of A. Y.'s memory and opinion, it is necessary to place in juxtaposition with the above extract, the following, from No. 884, p. 130. "Mr. Wigney's 'Atomic Theory,' set forth with such a learned array of abstruse expressions, differs in no one particular from what has long been before the public." And yet this atomic theory which A. Y. says differs in no one particular from what has long been before the public, is now said to furnish the principal novelties presented to attention. So much for the consistency of A. Y.'s contradictory declarations. And if he now means to consider me as the author of that theory, so far as relates to the laws of equal diffusion and recession, I feel no reason to be ashamed of the production, for any thing which A. Y. has yet shown of their inconsistency.

Having next expressed a half inclination to yield up the realms of unoccupied space to me, in which to exert the diffusive force of heat against nothing, without any farther opposition on his part, A. Y. seems determined to oppose with all his reasoning powers, the diffusive force of heat, when arrayed in opposition to the aggregate forces and affinities of atomic composition; and he promised, "by a little practical test," to prove the inadequate capability of heat by the physical energy conferred upon it by the law of equal diffusion, to overcome the aggregate forces and affinities of the atomic constitution of bodies; but in vain have I again and again searched the residue of his letter for this "little test," and cannot find it. It is true that I have met with much declamation and positive assertion, but no illustrative "little test," and as A. Y. was perhaps at a loss for some practical proof to illustrate the incapability of heat to separate the atoms of bodies from each other, when united together by "the aggregate forces and affinities of their constitution," I will help him to two subjects to serve the purpose, and only two, lest the exertion should be too much for him if I offered more. First: How is it that the stoutest pipes, made of the strongest materials, burst, when filled with ice, during the time that such ice is converted into water,—by the impartation of heat thereto from the atmosphere, in spite of the "aggregate forces and affinities of the atomic constitution," of the material of which such pipes are composed? Secondly: How is it that boilers burst upon the impartation of heat from burning fuel, in spite of the immense power of "the aggregate forces and affinities of atomic constitution," of the thickest and strongest material that can be manufactured, and of which they are made? And if A. Y. can furnish your readers with proof of the existence and exertion of a superior power than is conferred by the law of equal diffusion, to which I imagine heat is subject, they will doubtless as well as myself, feel obliged to him for the information.

A. Y. appears to me, next, to have occupied much time and space in mystifying the theory which I had endeavoured to render plain and perspicuous, by confounding and mixing up latent heat with thermometric, and citing the composition and properties of a variety of substances, to disprove the correctness of the theory which I have endeavoured to establish. But I trust that my opinions are so amply and clearly recorded in your work, and the judgment of your readers so well informed on the subject, that I need not further weary them and myself by their repetition, or waste your pages by an analytical decomposition of the remainder of A. Y.'s letter, which to accomplish effectually would require much more time than I can at present spare, and the occupation of much more space in your work than I can consistently request or expect; and thanking you for the indulgence you have already shown me, and apologising for the intrusion which the necessity for self-vindication induces,

I remain, Sir,
Your obedient Servant,
G. A. Wigney.

Brighton, May 13, 1841.

THE NEW THEORY OF THE UNIVERSE.—
E. A. M. IN REPLY TO R. C.

Sir,—R. C. has nearly acquired a full idea of my theory. I must ask indulgence for the trouble which my want of acquaintance with scientific terms occasions. The firmamental fluid is unique; but as there is nothing unmixed in nature, so this fluid sustains, at certain distances, in a state of separation, the atoms of water. Thus, it is positive cold. During its connection with the living body, instead of the atoms continuing separately in the fluid, they combine into globules, enclosing portions of the fluid; these globules, ever in motion, (no such thing as a perfect equilibrium existing,) constitute positive heat. The various kinds of heat, beginning with the globe of twelve atoms,* (the first form of nature,) then twenty, &c. The different degrees of heat, as the sedative cold of the firmamental fluid is destroyed, it would not be possible to calculate.

I am rather inclined to believe, that in a difference of arrangement of atoms with firmamental fluid all the variety of nature may be accounted for—the atom of water, or (strange as it may seem) of carbon, being assumed as the true one. In my first communication I attributed the separation of land into distant globes to a repulsion due to vegetable decay: I see no cause for changing this speculation, since all buoyant particles originated with vegetation. All solids, in the present state of things, acquire buoyant atmospheres: these atmospheres occasion the continuance of motion from previous impulse. An artificial atmosphere carries the cannon-ball to its mark: a continually renewed atmosphere conveys the world on its course. I have no objection to the term specific gravity, provided the idea of *attraction* be not attached to it. The accelerated motion of falling bodies is occasioned by the dispersion of the buoyant particles allowing an accumulating force of the firmamental fluid, increasing with the distance of the fall. At the present moment, one of the most interesting questions involved in my theory would be, "To what distance would the lateral absorption of air, by a steam-vessel, produce the effect of attraction, the repulsive exhalations being entirely ascensive? And, with two steam-vessels, what would be the increase of attraction? Also, under what circumstances this effect would probably be increased or diminished."

I should regard the further remarks of R. C. as a favour.

Your obliged servant,

E. A. M.

July 3, 1841.

* It was probably this globe of twelve atoms that gave rise to the duodecimal reckoning.

*From the same.*

Sir,—I am desirous of making an observation on the term "atom of water," in my communication of the 3rd instant. Atoms of carbon and atoms of water would be the same things, because there is no intermediate form between the atom and the thing named, but if I were to speak of an atom of caloric, the atom of caloric would consist of twelve atoms of water, with its contained firmamental fluid. Perhaps such atoms ought to be called nominal atoms. I wish to explain what I mean—the propriety of the explanation I leave to the judgment of more able and more scientific persons than your obliged servant,

E. A. M.

P.S. Within what is called the earth's atmosphere, the natural buoyancy immediately surrounding a solid would not resist the effect called attraction, which is occasioned by the absorption of the firmamental fluid. Had it not been for the action of heat previous to solid accumulation, there would, or might have been a fixed point for matter to have rested on, and to have stood still, pressed by the firmamental fluid in the centre of the universe.

I am much obliged to R. C.

July 4, 1841.

SOUTH POLAR EXPEDITION. THE CAUSE OF MAGNETIC ATTRACTION DISCOVERED: ITS THEORY, NATURE, ABERRATION, AND ORIGIN ELUCIDATED. WITH ADDITIONAL DATA AND OBSERVATIONS.—BY LIEUTENANT FRANCIS HIGGINSON, R. N.

*Introduction.*

Amid the phenomena which have for ages attracted the attention and excited the curiosity of mankind, the polarity of the magnetic needle, or its tendency to point northward, has perhaps been the greatest and most permanent. Perpetually under the observation of the mathematician and navigator, innumerable have been the theories proposed, experiments instituted, and voyages undertaken, having for their object an analysis of the principles which originate and govern this most singular effect.

That a nation such as ours, pre-eminent in science as in war, upon an element whose subserviency to every purpose so entirely depends upon the magnet, should have been foremost, most assiduous, and persevering in this pursuit, will appear but natural when her situation, possessions, interests, glories, and reputation are considered. And proud indeed is the reflection, that, even failing in the principal object contemplated, disappointment so enshrined itself in heroic achievement up-

on these occasions, as to render it problematical which was most worthy of admiration —the greatness of the pursuit, or the fortitude, courage, and devotion, by which labours the most stupendous were accomplished; perils, destitution, and suffering encountered, submitted to, and overcome. In short, an appropriation of the energies of war to the purposes of science, that Britain only could have exhibited; and which may be truly regarded as triumphs, alike worthy of her greatness and characteristic of her powers.

Thus far premised, it may be admissible to mention, that, having entered early into the naval service, the compass, at first an object of curiosity, soon became a subject for study; the causes of its apparently mysterious and incomprehensible powers absorbing every other consideration. This pursuit, cautiously followed and sedulously concealed, from motives which the enthusiastic will readily comprehend, subjected me to many inconveniences, and some misconstruction. There were moments, however, of triumph and exultation, which compensated for all—when labour, chagrin, and disappointment were alike forgotten—a step advanced, or an idea confirmed by experiment, rewarding the past, and affording for the future the strongest possible incentive to continued exertion.

It could answer no useful purpose to enter here into a definition of first ideas, or trace minutely the several theories I from time to time adopted, disproved, and rejected. Particularly, as the following Memoirs, addressed to the Royal Society, contain a description of the experiments and observations which ultimately convinced me, that the polarity of the magnetic needle does not depend upon any local attraction on or within the earth, but is excited by an influence contained wholly within the surrounding atmosphere. At the same time, it may not prove uninteresting to mention an incident, by which the entire direction of my studies was changed, after years of labour and research, based upon the usual supposition of an attractive body being situated at or near the north pole; and whence I first obtained an insight into the actual causes of the phenomenon now under consideration.

Events which are irrelevant, and the prospect of a long peace, induced me to seek experience at sea, and opportunities of following out this investigation in the merchant service. Upon one occasion, whilst anchored in a calm off Cuba, a luridly hazy, rather than clouded sky, produced the heaviest rain I ever witnessed. Awaiting the result, prepared to weigh, and anticipating wind, whilst looking at the mast-head vane of the schooner, I perceived at first a faint spark upon the spindle, which gradually expanded into a large and brilliant light: a nucleus of the deepest crimson shot forth straw-coloured scintillations, which rendered not only the vane, but the topmast-head distinctly visible.

This appearance, denominated a *compasant* by seamen, probably a corruption of the *corpo santo* of the Portuguese, being the most vivid I had ever seen, became for some time an object of exclusive attention. But turning at length to look at the compass, it would be impossible to describe my astonishment on perceiving it was nearly reversed. The vessel's head was still about south, by the known bearings of the land we were close under. The compass, notwithstanding, indicated the opposite point, vibrating between N.N.E. and N.N.W., with a tremulous oscillatory motion; its south pole being greatly depressed, and north point proportionably elevated towards the cause which evidently excited its aberration.

Lightning, which merits the description of being awfully intense, accompanied by thunder resembling rather a continuous and deafening scream, than the usual detonation, succeeded to and terminated this appearance. The compass instantly resumed its functions, upon the extinction of the meteor, and continued undisturbed during the night by these more ordinary manifestations of concentrated electricity.

Upon another occasion, in a colder climate, and under less favourable circumstances, I was fortunate enough to observe at the mast-head a beautiful and distinct appearance of compasant. The compass, in this instance likewise, by its tremulous, vibratory, and oscillating horizontal motion, with depression of its south pole, and deviation from the magnetic north, showed that it was acted upon, although not to the same extent, in a manner precisely similar to that above particularised.

Pursuing with avidity an idea which immediately suggested itself, that the cause of magnetic attraction was contained wholly in the air, and was an effect of electricity, every succeeding year, and reiterated experiment, tended but to establish the fact and produce conviction. At length, finding that the active duties of my profession, from the apparatus required, interfered with my further progress, being then employed afloat, I deemed it a patriotic duty to submit to the Royal Society a detail of my discovery and experiments, in order that the results might be rendered beneficial to my country, by indicating a better course towards solving the problem of magnetic attraction, and thereby obviate any unnecessary sacrifice of her treasure, or misdirection of her energies—an object which I have every reason to be satisfied has been perfectly attained.

### MEMOIR I.

It may be necessary to premise, that, having for nearly twenty-three years been constantly employed in the naval and merchant services, the several peculiarities of the magnetic needle have come extensively within the sphere of my personal observation. The result was, that I was ultimately induced to suspect the tendency of a magnetized bar to point northerly did not arise from any attractive influence or body upon the earth, situated in that quarter, but was a quality contained in the surrounding atmosphere, originating in, or being greatly influenced by electricity.

Without apparatus, and at such intervals only as I could snatch from professional duties, my progress in the determination of this problem was necessarily encumbered with indescribable difficulties. I trust I have, however, succeeded to an extent which may render farther investigation not only desirable, but necessary.

Permit me, therefore, in furtherance of this object, to observe, that having rendered a common sewing-needle magnetical, and thrust it to the centre through a cork ball of sufficient size to keep it afloat, on dropping it into a basin of water, I satisfied myself of its polarity and correctness by repeatedly comparing it with different compasses.

Procuring then as perfect a vacuum as I could obtain, by consuming, not extracting the air from a vessel wherein the basin and needle were placed, I had at once reason to be satisfied, imperfectly as the experiment was made, that the magnetic influence or attractive principle is contained wholly in the surrounding atmosphere. Whilst, that electricity is the great exciting cause of that attraction was sufficiently manifested by the agitation of the same needle in vacuo, when brought within the influence of a machine but moderately charged.

The dip of the needle, scarcely perceptible at the equator, becomes considerable, at different ends, upon approaching either of the poles, where the manifestations of electricity are always the most obvious. May the variation be similarly accounted for, supposing a greater quantity of electricity to be in operation, at certain periods, in different quarters, diverging from west to east, and the reverse, on principles yet undetermined, and laws at present unknown?

For many years I have looked forward to the era, when a temporary retirement from the more active duties of my profession might have afforded me both leisure and opportunity of uninterruptedly following this investigation. Circumstances have, however, tended to render my anticipations nugatory. On mentioning to some friends the conclusions I had arrived at, their recommendation induced me to solicit the attention of the Society to the facts particularised, satisfied that by none can the subject be better understood, or so ably, thoroughly, and judiciously investigated.

### MEMOIR II.

*Theory —Electricity the cause of magnetic attraction.*

Satisfied, by experience, that any light thrown upon a philosophical subject in itself forms the surest claim to the attention of the Royal Society, I venture, in addition to my former memoir, respectfully to submit to their consideration a detail of facts and circumstances, which convince me, from protracted and sedulous observation, that magnetic attraction originates in, and is wholly an effect of electricity.

That in the establishment of this position there are many difficulties to encounter is sufficiently obvious; to the ardent and inquisitive, however, the possibility of success at all times counterbalances the probability of discomfiture. Ingenious theory, the offspring of genius and assiduity, it will be admitted, is always to be controverted with cautious delicacy; and even the established prejudices of mankind, when refutation is desirable, regarded with deference and respect.

In applying these observations to the hypothesis of Dr. Halley and others, respecting the magnetism of the whole earth, it will be evident the extent of their researches is sufficiently understood, their genius, talent, and observation appreciated and confessed.

If, however, instead of supposing with Dr. Halley, "that the earth consists of an external shell or hollow sphere, and an internal nucleus, each being a separate magnet, indued with two poles, whose magnetical axes are not coincident," in order to account for the variation of the compass, the same result may be considered to arise from natural causes, originating and being brought into action on the surface of the globe by the surrounding atmosphere: a less intricate and abstruse theory will readily present itself.

It may, notwithstanding, be desirable to attempt an elucidation of the causes of magnetic attraction, before entering into a dissertation upon one of its peculiarities.

That the air is the immediate agent whereby magnetism is conferred, a simple and practicable experiment has repeatedly demonstrated. Any straight bar of iron, which in the northern parts of the world stands for any considerable time in a vertical position, acquires the property of attracting other iron at its extremities; and, if properly suspended, conforms itself to a direction nearly in the plane of the meridian; or, in other words, becomes a magnetic bar, the end

which was downward in its perpendicular position always pointing towards the north. This effect was, however, never produced on a common knitting-needle in vacuum, suspended for years in a bottle, from which the air was excluded; although another needle became magnetical in a similar bottle, to which the air had access, from the cork remaining out.

The medium of communication being thus defined, the causes of magnetic attraction present themselves for elucidation within a narrower compass. If, indeed, it is admitted that the same causes ever produce the same effects, a conclusion is readily arrived at. A strong electrical shock gives polarity to small needles; which may likewise be conferred on a bar of iron, by placing it firmly in the position of the dipping-needle, and rubbing it all one way with an instrument of polished steel: friction upon reflecting surfaces being at all times the readiest means of concentrating electricity.

These premises admitted, a simple and comprehensive theory of the causes of magnetic attraction, it is with deference imagined, is without difficulty evolved.

That the great body of the globe we inhabit is principally composed of metallic ores, its density, as compared with the larger planets, sufficiently demonstrates; and that iron is the predominant metal it contains, positive investigation has rendered incontrovertible. That at least the external parts of a sphere of this description, revolving nearly in a vertical position, would become magnetical from the action of the surrounding air, as now existing, the effect produced upon a bar of iron placed perpendicularly is in itself an indication. That this result can only be an effect of electricity remains to be defined.

An immense globe like the earth, revolving with a rapidity scarcely comprehensible, in a medium such as the air, and subjected to its concomitant friction, would, it is clear, from the structure of the plate and cylindrical apparatus, naturally collect or elicit that latent element which we denominate electricity. Certain peculiarities, arising from natural causes, would occasion a greater proportion of this matter to collect in particular localities; such as the existence of extensive fields of perpetual ice, which in themselves form, with relation to the earth, on a colossal scale, the nearest possible approximation to a sheet of glass laid upon a nearly horizontal plate of insulated metal.

The deduction is obvious. If electricity, under any circumstances, by its sole agency, will confer polarity, it is self-evident that element alone can be the cause of magnetic attraction. The limited knowledge we at present possess on the subject, or mode of application, at once accounts for its requiring what is considered a very strong shock to render even a small needle magnetical. That it will do so at all, is a sufficient manifestation of its peculiar capabilities; and the largest conceivable magnet, as compared to such a machine as the earth, would indeed be an atom.

Presuming from these inferences that electricity is the cause of magnetic attraction, and in consequence of the perpetual existence of immense fields of ice at either pole, presenting at all times surfaces the best adapted to its propagation, that a greater proportion of electricity would be there located, it is natural to inquire what would be the probable results, polarity itself having been, by this agent, admittedly conferred.

At the equator, being equi-distant from the great reservoirs of exciting matter, the needle similarly acted upon at either extremity would be an equipoise. Advancing to the northward or southward, the attracted end would naturally be influenced by an increasing force, and endeavour to conform to the place of its attraction, without reference to the intervening portion of the earth's circumference, and visible horizon. This, then, would be the dip.

I admit that I am sceptical as to there being any dip of the needle whatever, impartially and sedulously observed, after the boundaries of perpetual ice are passed at either pole, convinced that the electrical atmosphere would so act upon the compass as to deprive it of its ordinary powers; or rather, as the great cause of attraction would be entered, a preponderance of electrical matter, in a certain space, the effect, whilst surrounded by that medium, would be inevitably discontinued. In fact, by a known property of electricity, as exerted by the apparatus we already possess, upon lighter substances, supposing the north point to be positively, and the south point negatively electrified, the compass would be reversed, as is the case with all other attracted agents, when brought within the influence of concentrated electricity.

The variation of the compass under these circumstances presents no incomprehensible peculiarity or aberration. That the electrical matter will, with ordinary incentives, and in all climates, collect itself into distinct spaces, is evinced by the occurrence of thunder squalls, water spouts, and other phenomena. How far the augmentation or diminution of the surface of ice presented at either pole, and shift of situation in the great body of that material in different years, added to other causes, may influence the divergence of the principal collection of electricity from its usual centre, remains problematical, and can only be determined by observation and experiment. That this pe-

culiarity in the compass originates in some inciting influence, in itself not immovable, may perhaps be assumed, when it is considered that the extent and boundaries of the divergence alluded to admit of demonstration.

Any allusion to experiments made upon the compass in vacuum is intentionally avoided, having been adverted to in a former memoir. It may, however, merit the attention of the learned and influential to determine how far investigation into the causes of magnetic attraction should be further carried, having reference to any other agency than atmospherical phenomena.

The aurora borealis, affording evidence of the existence of greater quantities of electrical matter at the north pole than elsewhere, and its admitted effects upon the compass, may here authorize a brief mention being made of, perhaps, the greatest difficulty by which the elucidation of this problem will be ultimately encumbered. Would an atmosphere so rarefied as to give rise to the appearance we name aurora, within the boundaries of its immediate influence, and where that appearance is originated, be sufficient for the maintenance of animal existence?

The results of experiment may authorise a doubt. In the vacuum of the air-pump, the electric matter passing between conductors, assumes precisely the appearance of the northern lights, which is never the case under any other circumstances. In high degrees of exhaustion the light indeed becomes less, whence it may be inferred that through the more perfect vacuum electric matter cannot pass. The least conceivable portion of air is, however, sufficient to serve as a conductor, whilst the resistance of the electric part being very small in consequence of the rarefaction, it then passes much greater spaces with the appearance particularised than it can do through an atmosphere of greater density.

It is simply necessary to allude to the effect produced on persons in a room where electrical experiments are making, to entitle these remarks to exclusive consideration.

It has not escaped me, that, like others similarly circumstanced, enthusiasm on this subject may have generated conviction. The conclusions arrived at, however, have been the result of some labour in a situation where labour was accompanied by difficulty; and are now submitted to the cognizance of your reverenced society, simply with a view to the determination of a question in which I am at once personally and professionally interested.

It has long been an object of my ambition to superintend the structure of a sphere principally composed of iron, into the poles of which two glass plates should be fitted to represent the arctic and antarctic circles. This sphere, I conceive, might be insulated in the usual manner, and made to revolve in nearly a vertical position, retaining its perpendicular direction, at all times. The object in view would be to determine, not only what space of time it requires to render a globe of this kind magnetical from the action of the atmosphere, but, likewise, whether it would act in any way as an electrical machine, and with what peculiarities. An attempt which I once made to accomplish this object, with the rudest materials, and my own workmanship, renders me more sanguine upon the subject than I would willingly express.

*Note.*—Since the period at which these papers were furnished to the Royal Society an expedition of discovery towards the south pole has been undertaken, consisting of H.M.S. *Erebus* and *Terror*, under the command of Captain James Clark Ross, R.N. And the interest which usually attaches itself to all voyages of this description has very recently received a great additional impulse by the appearance in the public papers of the following annunciation:—

"Antarctic Expedition.—The magnetic experiments which Captain Ross was charged with making in the *Erebus* and *Terror*, had, it is said, induced him to entertain the idea that he could solve the problem of magnetic influence, in so far as to establish the position that it does not depend upon the earth."—*United Service Gazette*, Feb. 20, 1841.

The fact of the magnetic attraction not depending upon the earth, it will be perceived by the foregoing memoirs was discovered and communicated by me to the Royal Society in 1835. It therefore remains to Captain Ross and the expedition but to confirm, not originate, this theorem.

That every thing which skill, courage, and enterprise can effect will be accomplished, not a doubt can be entertained. It is, however, for the interests of all, that a distinct line of demarcation should exist, distinguishing that which is already known, from any thing hereafter actually discovered.

To supply therefore a desideratum, this publication is undertaken; and from a conviction that discussion cannot prove unacceptable at the present era, upon a subject of so much interest in nature, and utility in science. At the same time it would be affectation to deny, that I consider in the light of a reward for years of unremitted research and patient industry, having the extent of my labours understood, and being known as the author of this important discovery. Feelings, I hope, admitting of avowal without necessarily subjecting me to the imputation of egotism; trusting these may be deemed in every sense legitimate objects of justifiable anxiety and honourable ambition.

SOLUTION OF THE 3RD MATHEMATICAL QUESTION. (SEE MECH. MAG. FOR MAY 2, 1840.)

Sir,—It is apparent, that if the sun can rise and set to two places in the same hemisphere at the same instant of time, one of these places must be elevated above that of the other. We shall suppose one of the places to be on the level of the sea, and in 36 north latitude, and the other on the south side of Mount Etna, in lat. 38 N., and that both places are on the same meridian, and the period of time to be Dec. 22, 1841. To determine the altitude of the position on the side of Etna.

1st, To determine the sun's meridian distance at rising on Dec. 22, 1841, in latitude 36 . . 0 N

| | | | |
|---|---|---|---|
| Lat. ......... | 36 .. 0 .. 0 N | sec. | 0·092012 |
| Dec$^n$. .......... | 23 .. 27 .. 36 S | sec. | 0·037471 |
| | 59 .. 27 .. 36 | | |
| Sun's zenith distance at rising | 90 .. 33 .. 0 | | |
| Sum ...................... | 150 .. 0 .. 36 | | |
| Difference .............. | 31 .. 5 .. 24 | | |
| Half sum.................. | 75 .. 0 .. 18 | sin. | 9·984954 |
| Half diff................. | 15 .. 32 .. 42 | sin. | 9·128104 |
| | | | 2)19·512571 |
| Half mer. dist............ | 36 .. 11 .. 56 | sin. | 9·771285 |

Hence the sun's meridian distance at rising is 36°. . 11′. . 56″ × 2 = 72°. . 23′. . 52″

Let Z represent the zenith of the position on the side of Etna; P the North Pole; S the position of the sun, the centre of which is supposed to be in the horizon. Then in the spherical triangle P Z S, we have given z P = 52° P S = 113°. . 27′. . 36″ and the angle P = 72°. . 23′. . 52″ to find Z S.

Assume, $\tan.\,\theta = \tan.\,PZ\,.\,\cos.\,P$

| | | |
|---|---|---|
| P Z = 52° .. 0′ .. 0″ | tan. .............. | 0·107190 |
| P = 72 .. 23 .. 52 | cos. .............. | 9·480558 |
| θ = 21 .. 9 .. 29 | tan. .............. | 9·587748 |

$\therefore PS - \theta = 92°\,..\,18'\,...\,7''$;

and $\cos.\,ZS = \cos.\,(PS - \theta)\,.\,\cos.\,ZP\,.\,\sec.\,\theta$

| | | |
|---|---|---|
| P S — θ = 92°..18′.. 7″ | cos. | 8·103594 |
| P Z = 52 .. 0 .. 0 | cos. | 9·789342 |
| θ = 21 .. 9 .. 29 | sec. | 0·030310 |
| Z S = 91 .. 31 . 7 | cos. | 8·423246 |

| | |
|---|---|
| Hence, from......... ................. | 91°..31′.. 7″ |
| Sub. 90 + celestial ref. (33′) ............ | 90 ..33 .. 0 |
| Sun's apparent dip..................... | 0 ..58 .. 7 |
| Add $\frac{1}{11}$ for terrestrial ref. .............. | 0 .. 5 ..17 |
| Sun's true dip. ......................... | 1 .. 3 ..24 |

Lastly, assuming the semi-diameter of the earth = 3978 miles. Then will the required elevation on the side Etna be $\frac{3978}{\cos.\,(1°\,..\,3'\,..\,24'')} - 3978 = \cdot 6764$ parts of a mile = 3571¼ feet.

P. S. There are many convents on the side of Etna at a much greater height.

ROBERT HACKSHAW.

47, Gloucester Place, Portman Square.

SHORT LIFE ANNUITIES.

Sir,—Your correspondent W. P., is referred to the *Penny Cyclopædia*, art. "Reversion," and to the Companion to the Almanac for 1840, art. 4. After studying these, he will probably be of opinion that the *accurate* method of calculation there exhibited is quite as easy as the *approximate* one supplied by Mr. Scott.

About ten years ago, I devised a method which differs from this, and is peculiarly advantageous in cases involving more than one life. As your correspondent's inquiries extend to single lives only, I would not bring forward my method on the present occasion.

Remaining yours, &c.

J. W. WOOLLGAR.

Lewes, May 27, 1841.

NAUTILUS'S THEOREM.

Sir,—I had not an opportunity of seeing the Magazine for June 19, until today: I find that Nautilus has fulfilled his promise, by giving a demonstration of his own theorem, (or rather one of a like kind.) I am very sorry, however, to be obliged to state, and that for a second time, that his demonstration is defective. He necessarily supposes that, in the continuation of the triangulation, (see his own diagram,) one of the lines, say X Y, drawn at right angles to A C, must meet or cut the straight line A B; but for this *essential requisite*, he gives no proof whatever, but takes for granted that it must be so. Now, to demonstrate that a straight line X Y may be drawn at right angles to A C, that will meet or cut the line A B, will be found to require a knowledge of those properties of parallel lines, for the truth of which his own proposition has been proposed, for the purpose of proving the 32nd of the 1st book of Euclid, independently of the 12th axiom or 29th proposition.

If we could demonstrate, without overstepping the prescribed limits, that D E is not greater than any of the lines E L, L G, G I, &c., then it might be easily demonstrated that X Y will meet or cut the line A B; but to prove that D E is not greater than E L, L G, G I, &c., would again compel us to trespass on forbidden ground. In fact, from any propositions anterior to the 27th we can learn little or nothing in respect of the magnitudes of the segments D E, E L, L G, G I, &c., and consequently we are at perfect liberty in making any supposition on this head we may think proper. Thus, we may suppose D E to be double E L, E L double L G, &c., then on this supposition, and from well-known principles, $DE + EL + LG +$, &c., to infinity; or $DE + \frac{DE}{2} + \frac{DE}{4}$, &c., to infinity, $= 2\,DE$; so that if D B be greater than 2 D E, the line X Y will never meet or cut the line A B; and there is no proposition anterior to the 27th that can exclude this last supposition.

It is rather singular, that Nautilus has fallen into an error exactly of the same nature as that of *Franceschinis*, late Professor of Mathematics in the University of Bologna, in an attempt he made to demonstrate the truth of axiom 12th, book 1st. See "Notes, page 406, *Playfair's* Elements of Geometry." In conclusion, I attach no censure to Nautilus: I am fully aware of the difficulties of the subject; and should he make another attempt, I trust he will be more fortunate.

I am, Mr. Editor,

Yours, &c.,

KINCLAVEN.

July 3, 1841.

OSCILLATING ENGINES.—AN INQUIRY.

Sir,—I should feel much gratified if you, or some of your numerous and talented correspondents, would state wherein consists the superiority of the "Gorgon" engines, of Messrs. Seaward's, over the oscillating engines so much used in small river boats; and why the oscillating cylinders have not been applied to larger vessels? In one of your former volumes it is stated, (I think by Mr. Field,) before a committee of the House of Commons, that the oscillating cylinders were suitable for vessels of any size, however large.

I am, Sir,

Your obedient servant,

INQUIRER.

## WALKER'S PORTABLE FULCRUM, OR IMPROVED FLOORING CRAMP.

(Registered pursuant to Act of Parliament.)

The necessity for some mechanical aid in laying flooring-boards has led to the introduction of various contrivances for this purpose; of several which have come under our notice, that which we are about to introduce to our readers seems to be the simplest, and fully justifies the statement of the ingenious inventor, that "it will be found a cheap and valuable contrivance, always insuring good work with facility and certainty."

Fig. 1.

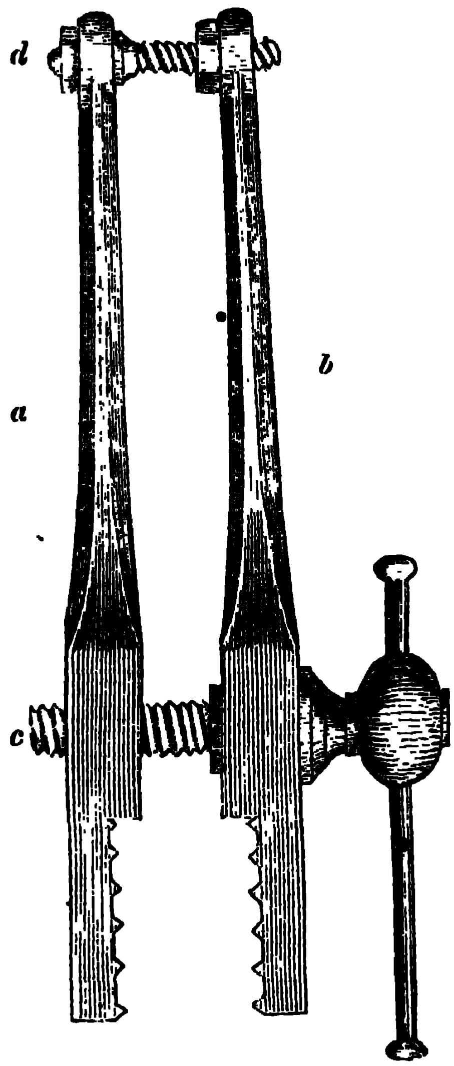
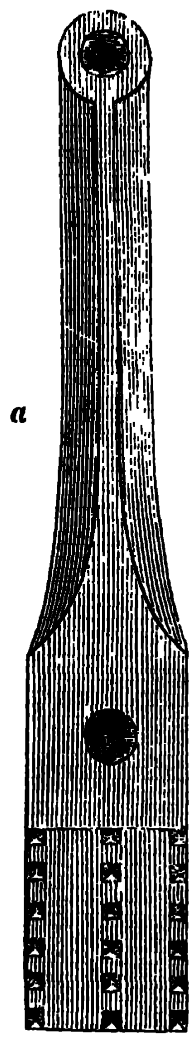



Fig. 2.




This instrument in appearance somewhat resembles a vice, as shown in the accompanying engraving. Fig. 1 is a view as seen edgeways, and Fig. 2 an inside view of one of the limbs detached. It consists of two limbs, *a b*, united by a large screw at *c*, and by a smaller screw and nut, *d*, at its upper extremity. The lower ends of the limbs are furnished with three rows of strong teeth, as clearly shown in fig. 2.

The upper screw having been adjusted to a proper distance, the instrument is placed across the joint, and the screw *c* tightened; a wedge of hard wood or iron is then driven between this fulcrum and the board to be laid, which is thus driven into close contact with its fellow. The fulcrum is then shifted to the next joint, and so on till the floor is completed.

These flooring-cramps have been employed in some of the largest building establishments, and, we hear, with uniform success; both masters and men speaking in the very highest terms of praise, of the convenience and advantages resulting from their employment.

*On the Nature, Properties, and Applications of Steam, and on Steam Navigation. From the Seventh Edition of the Encyclopædia Britannica. By John Scott Russell, M.A., F.R.S.E., Vice-President of the Society of Arts for Scotland, &c. &c. &c.* Edinburgh: Adam and Charles Black. 378 pp. 12mo., with 15 plates.

Although the greater demand, of late years, for information on the steam-engine, and its application to navigation, is pretty well shown by frequent new editions of works on the subject; still, as a mere branch of general knowledge, it is, in relation to its importance and the interest of its rise and progress, comparatively unknown. Except the professional man, or one who may be fairly classed among men of science, how few are there of the hundreds of thousands who yearly derive their chief convenience from this wonderful agent, who know, or care to know, any thing about it! They are, in the mass, as dull and lethargic to its science, as they are careless of the honour of their country in giving birth to its authors. And yet we are well assured that every individual would derive additional enjoyment, whether borne along on the waters of the Thames, or down the rapid stream of the Rhine, could he visit the engine-room with a knowledge of what is going on there. The most surprising invention ever permitted to man to bring to perfection; the interval of nearly twenty centuries between its origin and completion; the deep thought, and profound research involved in the discovery of its principles; the astonishing expansion of that element which is its breath of life, and its magical contraction into its former space; the god-like capacity of that intellect which enabled man to create a power so far superior to that of man, and yet subservient to his every want; the perfection of mechanical science, by which that power is adapted to its mighty purposes; and the immense mass of matter set in motion—its irresistible strength, yet wonderful docility; in every aspect, in short, in which it can be viewed, it offers to each, and all, from the scholar to the veriest pleasure-seeker, who owes his ease and safety to its power, sources of information as extensive in the range they embrace, as they are, assuredly, interesting. What then prevents the spread of this knowledge? It is the repulsive husk in which the rich fruit is dressed—the dry calculus, the algebraical formulæ, the uncouth garb, in which our men of science of this day wrap up their accumulations, that disgust the mere general reader. The beauties of language, the imaginative simile, the metaphorical allusion—given to man for the purpose of strewing the dry path of science with flowers—these seem banished from most of our scientific discourses. Let the example of the mighty Bacon in past days, and of Professor Whewell in the present, be cited as evidence how delightfully the abstrusest philosophy may be combined with the elegances of literature. In the "History of the Inductive Sciences" of the last-named author, we are led on by the beauties of a fine poetic taste, by a wide range of illustration, by original poetical mottos, and a lively fancy, each however made subordinate to the subject, and each, like a small rivulet, emptying itself into the deep stream of his philosophy, till the reader is enticed to wander on its banks, and learn while he admires.

We are led to make these remarks by a new work on Steam, and Steam Navigation, by a gentleman in high estimation, Mr. John Scott Russell, in which science and interesting information are equally combined. All who wish to have by them the most comprehensive compilation, and latest experiments on steam, as well as all who desire to become acquainted with the origin and progress of steam navigation will find in this work more complete and various information on both points than can be found elsewhere. Written for the last edition of the *Encyclopædia Britannica*, it has been published as a separate work, and may please equally the man of science and the man of leisure. To the former, indeed, the work is more particularly valuable, as it comprises not simply all

the best experiments made in this country from the time of Dr. Robison and Mr. Watt, to Dr. Ure, on the elastic force of steam, but also the more costly experiments in France and America, with tables of the former adapted to English measures. The experiments made in France were of a very grand description, the law of the elastic force of air under high pressure being determined by a column of mercury from 75ft. to 80ft. in height, and conducted with great care by two of the most illustrious of the French sçavans, MM. Arago, and Dulong, whose names are a sufficient guarantee for the accuracy of their results. We may now perhaps say that these investigations have removed the difficulties of the question and exhausted it. To collect, arrange, and clearly to reduce to our measures, all the various experiments on this interesting subject, was long an object of importance, and we are glad to find that this has at length been accomplished, and accomplished so well by Mr. Russell.

The author having in his preface modestly expressed himself as ready to receive correction where he has committed errors or omissions, we shall draw his attention for a second edition, —for we doubt not it will become a standard work—to one or two of the former, and to suggest some additions which we think will make the work still more complete.

With a praiseworthy regard for the honour of Great Britain, Mr. Russell has gone pretty fully into the inquiry respecting the rise and progress of steam navigation, but which nevertheless he has investigated in the spirit of a philosopher not with the bias of an individual, like the American Renwicks, weaving a web of sophistry over the clearest explanations, and disturbing the simplicity of truth to secure the honour of the invention to their own country. We think Mr. Russell has very conclusively set this question in its true light as regards the claim of America, and that after reading the following extract none but the most ignorant, or most wilful perverter of truth will attempt in future to wrest the wreath from Great Britain, as the country wherein was first practically proved the application of steam to navigation. We will first dispose of the claim of America, and show that it was from the knowledge derived from Symington that Fulton was enabled to build a steam-boat there, and in a subsequent number we will carefully investigate the claims of Miller, Taylor, and Symington in this country.

Mr. Russell observes:

"We have now reached that point of our history, where the glory of having introduced steam navigation to the attention of the world leaves its inventors, to irradiate the names of others who reaped the benefit of their labours. Of those men who have occupied the largest space in the world's eye, in connexion with the history of steam navigation, there stands out first and most prominent the name of FULTON.

"Robert Fulton, an Irishman by blood and an American by birth, was born in 1765, in Little Britain, in the State of Pennsylvania. His parents were humble and poor, and gave their son no more than the ordinary rudiments of English education at a country school; but his taste for mechanics and drawing developed itself in early life, and at the age of seventeen the self-taught artist was able to earn a livelihood by his pencil. At the age of twenty-one he had acquired the acquaintance of Franklin, and had accumulated a sufficient sum, from the savings of his industry, to purchase a farm for his mother; and undertake, in 1786, a journey to England, for the purpose at once of cultivating his art and pushing his fortune. In both of these he appears to have been tolerably successful.

"Some years after this, Mr. Fulton appears to have been directing his attention to mechanical projects, for in 1794 we find him taking out a patent for improvements in canals; and especially for a double inclined plane, forming a substitute for locks in the translation of vessels to different levels on a canal. He now began to assume the title of *Civil Engineer*, under which title he brought out a treatise on Canal Navigation. About the year 1797, Mr. Fulton emigrated to Paris, where he resided for the seven following years, in the house of his countryman, Joel Barlow. Here be endeavoured, by assiduous study, to supply the deficiencies of his early education, and became the inventor and proprietor of panoramic exhibitions. But the principal subject that occupied his attention during this period of time seems to have been a project of submarine warfare, submarine locomotion, and submarine explosions. To this subject he appears to have devoted

himself with all the energy, and we may say with all the infatuation, of a most sanguine schemer. In 1801 we find him at the harbour of Brest, making experiments with his submarine boat, which he called the Nautilus, attempting to blow up the English ships then blockading the coast of France, with his submarine bombs or torpedoes. The only result of his labours, however, was this, that on one occasion he got very near an English seventy-four, which moved out of the way just before he had time to blow her up.

"Disappointed in France, Mr. Fulton opened a negociation with the British Government, to apply himself with equal ingenuity to the invention of machinery calculated to blow up his former allies, the French; but in this attempt he was equally unsuccessful.

"Mr. Fulton was obviously one of those men who delight in the exciting occupation of following out new schemes and projects; and it is not a little curious that he should have arrived in England just before the date of the trial of the Dalswinton and the Carron steam-boats, so that his attention must have been very naturally attracted to so interesting a mechanical subject; that his attention was so directed is shown from sketches and memoranda on the subject, found among his papers. We also find him writing to Scotland, to obtain information regarding Mr. Miller's vessels. But it does not appear that the subject was seriously entertained by Mr. Fulton until an ulterior period, at which we shall now resume the thread of our history of steam navigation.

"While Mr. Fulton was in Paris, he appears to have entered into conversation with *Chancellor Livingstone*, at that time (1801) the representative of America at the court of France, concerning the importance of the new application of steam power to the navigation of the lakes and rivers of their own country. It should be premised, that Livingstone had himself been engaged about nine years after Miller's successful experiments, in an attempt to introduce steam navigation in America, in which he was conjoined with a person of the name of Nisbet, and assisted by the mechanical talent of Mark I. Brunel, the engineer, whose ingenuity has gained him so much reputation in other departments of mechanical combination; but the attempt had entirely failed, and did not produce a speed of three miles an hour, and the project was abandoned. Mr. Livingstone, however, spoke to Mr. Fulton of his intention to resume the subject on his return to America, and desired him to cooperate with him in the enterprise, and to direct his talent for mechanical combination towards that object. Mr. Fulton at once agreed to devote to the subject as much time as he could spare from his favourite schemes of submarine explosion.

"We have great pleasure in bearing testimony to the judgment with which Mr Fulton proceeded in commencing his career in steam navigation. Mrs. Barlow, the lady of his friend already noticed, was ordered to Plombieres by her physicians, in the spring of 1802, and was accompanied by Mr. Fulton, who forthwith employed his leisure in experiments on models, for which the small stream that runs through that village afforded adequate facilities. He appears to have been satisfied that endless chains, with floats attached to them, made to revolve by wheels on the surface of the water, were the best apparatus, and therefore preferable to Mr. Miller's paddle-wheels.

"But Mr. Fulton found he had been anticipated in this idea by a Frenchman, named Des Blancs, who had taken a patent for propelling boats by what he called chaplets, which were exactly Fulton's endless chains, and had also made experiments with them at great expense, without commensurate success. Mr. Fulton was thus thrown back upon Mr. Miller's original plan of propelling by the steam-engine acting on paddle wheels. He accordingly, in the winter of 1802-3, made a small model, and wrote a description of a small steam-boat with paddle-wheels.

"About the same time, Mr. Livingstone and Mr. Fulton commenced the construction of an experimental steam-boat on a larger scale. It was launched in the spring of 1803, on the Seine, below Paris, and the Steam engine and boilers were put on board. Mr. Fulton had, however, made the same mistake which many steam-boat builders have done at a much later date; he miscalculated the strength of his vessel, and when the weight of the machinery was placed in the centre, she broke through the middle and went to the bottom.

"The shattered vessel was raised, and was found to be almost entirely broken up. How admirable are the lessons inculcated by a thorough failure! The American steam-boats have ever since been distinguished by the excellence of the strong and light framing by which their slender vessels are enabled to bear the weight and strain of their large and powerful engines.

"This disaster compelled Mr. Fulton to devise the means of so strengthening a vessel, as to carry with safety her engines and machinery. He was obliged to set about building an almost entirely new vessel to carry his machinery, which suffered very little from its submersion, and at length in August 1803, Mr. Fulton made an experiment on his vessel. The vessel was sixty-six feet long, and eight feet wide, but she moved so slowly as to be altogether a failure.

"It was soon after this experiment with the steam-vessel, that Mr. Fulton came over to Britain for the purpose of engaging in the torpedo warfare, and turning those dreadful submarine engines against his allies in France. It will be readily conceived, that after having encountered so many difficulties in his own attempt at steam navigation, he would not allow any opportunity to escape, of obtaining information regarding the progress which had been made in Scotland since his departure; especially as the performance of his experimental vessel, notwithstanding his having employed Mr. Miller's plan of propelling by wheels had fallen so far short of the performance of both the first and second vessels constructed by Miller, Symington and Taylor. Now our readers will recollect that before the date of Mr. Fulton's return to Britain, 1803, Mr. Symington had constructed a third steam-vessel, with which, even on the canal, he obtained the velocity of six miles an hour. We may also add, that the fame of Mr. Symington's experiments had by this time attracted much attention throughout Great Britain, and he had already received an order from the Duke of Bridgwater to construct steam-vessels on his plan, for his canal. We accordingly find that Mr. Fulton availed himself of his residence in Britain, to pay a visit to the scene of these successful experiments. It is clearly established, that while Mr. Symington was carrying on his experiments under lord Dundas with his third steam-vessel, and endeavouring to introduce steam as the towing power on canals, the following occurrence took place:—Mr. Fulton called upon Mr. Symington, and introducing himself, told him that being about to return to America, he had heard of the steam-boat experiments, and could not leave Great Britain without first waiting on Mr. Symington, in the hope of being allowed to see the boat, and to obtain such information about it, as he (Mr. Symington) might be willing to communicate. Mr. Fulton then mentioned, that, however advantageous steam navigation might prove to Great Britain, it would certainly become much more so in America, on account of the many extensive navigable rivers in that country, and as timber of the best quality both for building the vessel and affording fuel to the engine could be purchased there at small expense, Mr. Fulton expressed his opinion that it could hardly fail to become beneficial to trade in that part of the world. Mr. Symington accordingly gave him all the information he desired, and put himself to considerable trouble for the purpose of affording him the best opportunity of satisfying himself of the complete success of steam navigation at that time in Scotland. Our readers will not, we hope, be displeased to have an account of the trip, from Mr. Symington himself, an account corroborated by the evidence of respectable witnesses.

"Mr. Symington, after giving an account of Mr. Fulton's introducing himself, and of a conversation between them, in which the latter proposed that they should participate in the advantages to be derived 'from carrying the plan into North America' continues: 'Mr. Fulton having thus spoken, in compliance with his most earnest request I caused the engine fire to be lighted up, and in a short time thereafter put the steam-boat in motion, and carried him from lock No. 16, where the boat then lay, four miles west on the canal, and returned to the place of starting, in one hour and twenty minutes, to the great astonishment of Mr. Fulton and several other gentlemen, who at our outset chanced to come on board.

"'During the above trip, Mr. Fulton asked if I had any objections to his taking notes respecting the steam-boat? to which question, I said, none; as I considered the more publicity that was given to any discovery intended for general good so much the better; and having the privilege secured by Letters Patent, I was not afraid of his making any encroachment upon my rights in the British Dominions, though in the United States, I was well aware, I had no power of control. In consequence he pulled out a memorandum book, and after putting several pointed questions respecting the general construction and effect of the machine, which I answered in a most explicit manner, he jotted down particularly every thing then described, with his own remarks upon the boat, while moving with him on board along the canal; but he seems to have been altogether forgetful of this, as, notwithstanding his fair promises, I never heard anything more of him till reading in a newspaper an account of his death.'

"We may readily judge of Mr. Fulton's astonishment, when he saw that successfully accomplished in a remote corner of Scotland, by a plain unpretending man, to which he had applied so much study and talent in vain. He had been propelled in a boat driven by paddles, in a narrow and difficult canal, at a rate of more than six miles an hour; whereas in his own vessel he had not got a speed of three. He was not slow to avail himself of his newly-acquired knowledge. He waited on the younger Mr. Watt, of Bolton and Watt, at their establishment near Birmingham, and, under a feigned name, made proposals to them to assist him by the construction of a

steam-engine suited to the purpose of propelling a steam-vessel. The disguise of Fulton, for whatever purpose assumed, was soon found out. Mr. Watt did not, however, allow this 'indirection' to interfere with the fulfilment of his bargain, and an engine to be calculated for the propulsion of a vessel at the desired speed was accordingly put in hand for Messrs. Livingstone and Fulton.

"Fulton having met with as little success in his plan of blowing up French frigates with English gunpowder, as he had formerly obtained in his attempts to blow up British frigates with French gunpowder, did not remain long in England. He returned with his friend Mr. Livingstone to America, where the marine engine of Messrs. Bolton and Watt was about to follow them. In the mean time, the success of Mr. Symington's boat had given them confidence and instruction; and Mr. Livingstone had written to America, and secured the monopoly of steam navigation to Fulton and himself, in the state of New York, for *their invention* of steam-boats.

"It was in 1806 that Bolton and Watt's marine engine reached America. It was used to propel the boat on Mr. Miller's plan, by the use of paddle-wheels. The shell of the vessel was launched in the spring of 1807, from the building yard of Charles Brown, on the East (Hudson) River; she was named the *Clermont*, (the name of Livingstone's residence.) and attained a speed of nearly *five* miles an hour. It is worthy of remark, in justice to the inventors of steam navigation, that the first vessel of Miller, Symington, and Taylor had a velocity of more than *five* miles an hour, in 1788; and their second, in 1789, went at a rate of nearly *seven* miles an hour; while Mr. Fulton, their imitator and follower, had himself been taken at a speed of above *six* miles an hour by Symington, in a narrow canal, several years prior to this date. The reader will easily understand that this performance on the part of the *Clermont*, even with the advantage of Mr. Watt's excellent engine, was such as to fall far short of Mr. Fulton's expectations. Such is the history of the introduction of steam navigation in America, in imitation of what had already been accomplished in Scotland.

"Although the invention of steam navigation was thus perfected in Scotland, and thence transplanted directly by Fulton to America, the mercantile success of the young art was much more immediate and rapid in the new soil than in the old country. In the old country, overgrown with old habits and prejudices, the young plant was overtopped and choked up, so that its progress was slow and difficult; while in the new and unoccupied field of America, watered by her mighty navigable rivers, it was early fostered and brought to maturity, so as to supply at once a new medium of communication, expressly suited to the singular position and character of that young country.

"It may not be uninteresting, and must certainly be instructive, to follow for a short time the young art of steam navigation, transplanted from Scotland to the new world, in its rapid progress towards maturity. We have seen Mr. Fulton's first boat, the *Clermont*, launched and set in motion in the spring of 1807. The following account of the first experiment is given with much *naïveté* by the American biographer of Fulton:—'Mr. Livingstone and Mr. Fulton had invited many of their friends to witness the first trial. Nothing could exceed,' says he, 'the surprise and admiration of all who witnessed the experiment. The minds of the most incredulous were changed in a few minutes. Before the boat had made the progress of a quarter of a mile, the greatest unbeliever must have been converted. The man who, whilst he looked on the expensive machine, thanked his stars that he had more wisdom than to waste his money on such idle schemes, changed the expression of his features as the boat moved from the wharf, and gained her speed; his complacent smile gradually stiffened into an expression of wonder. The jeers of the ignorant, who had neither sense nor feeling enough to suppress their contemptuous ridicule and rude jokes, were silenced for a moment by a vulgar astonishment, which deprived them of the power of utterance, till the triumph of genius extorted from the incredulous multitude which crowded the shores shouts and acclamations of congratulation and applause.' The boat had not been long under way when Fulton ordered her engine to be stopped. The paddle-floats were too deeply immersed in the water, and he had them brought nearer to the centre, so as to lessen the diameter of the wheel, and take less hold of the water; and when they were again put in motion, it was manifest that the alteration had increased the speed of the boat."

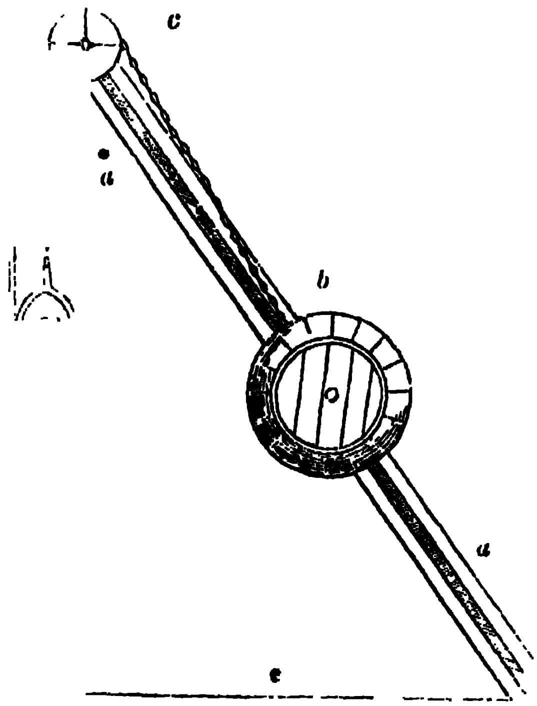
(*To be continued.*)

PAINTING WITH COLOURLESS FLUIDS.

At a recent conversazione of the Society of British Artists, Pall Mall, Mr. Stephens, of Stamford-street, exhibited a novel kind of experiment, peculiarly interesting to art-

ists. He showed the possibility of painting coloured drawings (without using any visible colour) by the effect of chemical combination. In other words, the colours were developed in the process of painting from the liquids used. Colourless liquids were applied to the surface, and by using them successively, and combining them with due reference to their chemical qualities of producing particular colours, a very novel and striking effect was produced. Mr. Stephens clearly demonstrated the possibility of painting pictures by this novel method, and one advantage attending its adoption would be, that the colours not being produced until they had entered into combination with, and dyed the texture of the fabric operated upon, the picture would not be liable to erasure by friction, as when precipitated colours only (as in the ordinary method of painting) are used. Of course a very minute acquaintance with the chemical nature of colours, and the combinations of which they are susceptible, would be necessary to the artist who would wish to execute with success this novel style of painting.

## NEW MOTIVE POWER APPLIED TO PUMPING.



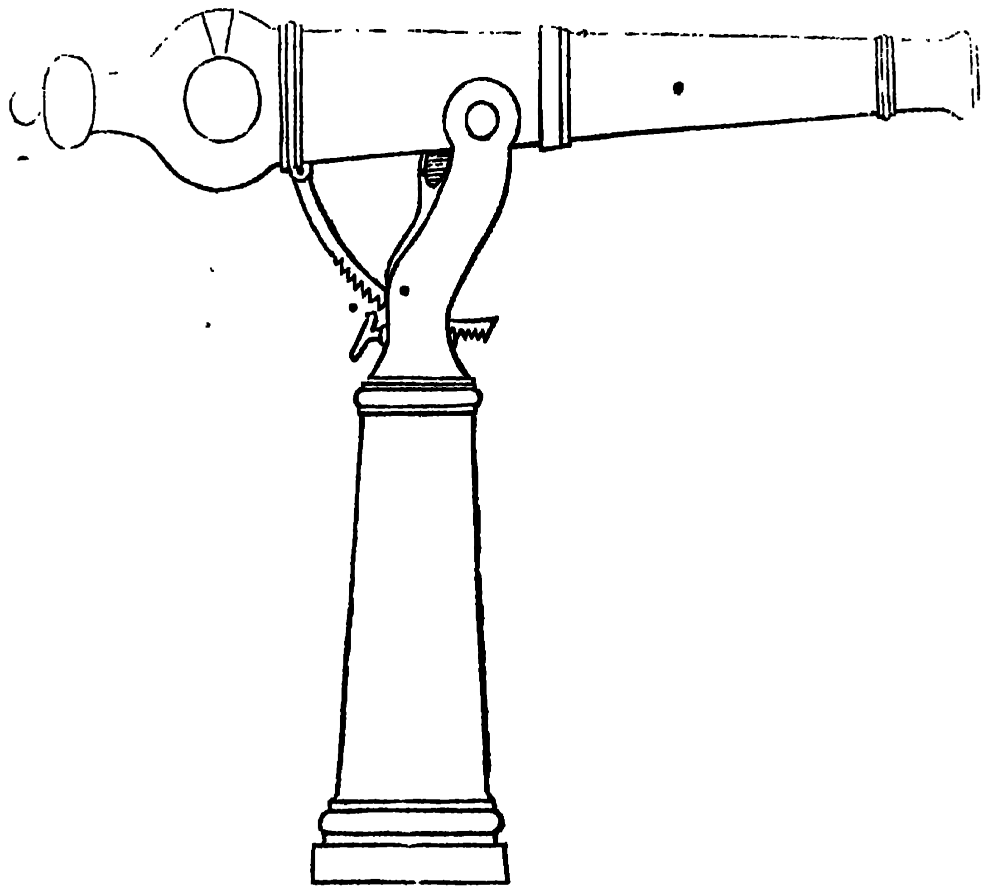

Sir,—A simple contrivance is about being erected near Brixham, Devonshire, by a Mr. Prior, for the purpose of raising water for washing ore, and which promises to be a great and general benefit, making useful a power, whose visitation has generally been accompanied with horrible devastation. Mr. Prior has succeeded in obtaining a motion to work a pump, by the action of the tide and waves. Two pieces of timber, *a a*, are laid out into the sea in a slanting direction as far as low water mark, and are strongly secured by iron work to the rocks; these timbers are about 4 feet asunder, having a groove in each. A strong cask *b*, having two gudgeons, slides up and down in these grooves, so that the least motion of the waves causes the cask to rise and fall. Attached to the centre of the cask, there is an eye of iron, into which a chain is fixed that runs over the pulley *c*, and is attached to the bucket of a pump of large dimensions. The bucket of this pump is of sufficient weight to sink of itself, keeping the chain tight, having room enough to traverse, so as to allow for the rising and falling of the tides the cask is about half filled with stone:, so as to counteract its buoyancy.

We must leave it to time to establish the value of this simple discovery; if worked upon a larger scale an immense body of water might be raised to any height by this power, and being caught in reservoirs, might be made applicable to drive any sort of machinery by means of water-wheels.

Yours, &c.

A CONSTANT READER.

GILCREST'S MORTIFEROUS ORDNANCE.



*Sir,—If you think the following description of a gun which I exhibited on the 24th of October, 1828, before the Marquis of Anglesey, Major-General Smith, &c., at the Phœnix-park, Dublin, worthy of a place in your Magazine, its insertion will oblige

Your most obedient,

John Gilcrest.

33, Constitution-hill, Dublin,
July 7, 1841.

*Description of the Gun.*

This gun is loaded at the breech, with ball cartridge, and the breech is closed by means of an iron cylinder, which revolves at right angles to the bore. This cylinder has an aperture, corresponding to the bore of the gun, pierced through it transversely, by which means, in every revolution of the cylinder, the breech is twice opened and twice shut. The breech being open, the gun is loaded by a man who stands behind it, who drops a cartridge into a trough, and thrusts it through the opening in the cylinder with an iron rod, which is affixed to the gun for that purpose: on turning the cylinder a quarter of a circle, by a lever, which is held by another man, the bore is closed, and the gun is fired by bringing a vent in the cylinder, which primes itself during the revolution, to a portfire fixed to the gun, and constantly burning. The gun can thus be made to fire forty or fifty times in a minute, that is, one shot every second.

CAUSE OF RAIN DURING THUNDER STORMS —AN INQUIRY.

Sir,—I shall be much obliged by your noticing the following inquiry in your Magazine, if the subject be not too inappropriate for its pages, viz., whether the electric flash, or the vibration produced in the atmosphere by the thunder, may be regarded as the *principal* cause of rain during a thunder storm?

I am, Sir,

Yours respectfully,

AN OLD SUBSCRIBER.

Derby, July 8, 1841.

A POPULAR MISQUOTATION CORRECTED.

Sir,—"Coincidence of ideas is somewhat remarkable," says Professor Murray, in his notice of my recommendation of the use of the gong on board steam vessels in a fog. Permit me to notice another instance in which the Professor and myself held similar notions. It is of a more trivial character, certainly, but may be a service to those who, like myself, Mr. Murray, and thousands of others, have made the old Master Butler talk nonsense. In the couplet attributed to him by the Professor, in his remarks on Davy's Lamp, he is made to say,

> "He that's convinced against his will.
> Is of the same opinion still."

That such were the words of Hudibras so firmly was I convinced, that, a short time since, I was fool enough to bet a trifling wager upon it; but on reference to the original book I found that the real words are—

> "He who *complies* against his will,
> Is of *his own* opinion still."
> *Hudibras Part 3, Canto 3.*

I am, Sir, &c.

THOMAS SHEPPARD.

Portsmouth, June 2, 1841.

BOOTMAKER'S BLOCKING MACHINE.

Sir,—Some time back there was a notice in your magazine of a bootmaker's improved blocking machine,* and also a letter from a bootmaker on the subject, recommending it to the notice of machinists in order to produce machines at a price which would place them within the reach of the generality of bootmakers. This I hear has been attended to, and I am told that some one at Pimlico makes them at £12 each; but although I have made inquiries of several in the trade, I cannot find either the name or address of the manufacturer. If any of your readers can supply this information, I shall be much obliged by their doing so.

I remain, Sir, yours respectfully,

A BOOTMAKER.

37, Leicester Square, June 18, 1841.

* Vol. xxxiii. p. 266.

ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

*** *Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for the purpose.*

JOHN BEATTIE, OF PORTLAND-PLACE, WANDSWORTH-ROAD, SURRY, ENGINEER, *for certain improvements in locomotive engines, and in carriages, chairs, and wheels, for use upon railways; and certain machinery for use in the construction of parts of such inventions.* Petty Bag Office, June 16, 1841.

The first improvement consists of an arrangement of apparatus for increasing the adhesion of the driving-wheels of locomotive engines on the rails. At the hinder part of the locomotive engine there is a vertical shaft, having at its upper end a handle, and on its lower end a bevel wheel, which communicates, through a second, to a third wheel on the end of a horizontal shaft extending along one side of the engine. This shaft has a right and a left-handed screw, placed some distance apart, each of which takes into a worm-wheel keyed or two vertical shafts, the ends of which terminate in right and left-handed screws working in four shackles; the two lower shackles are attached to the engine-frame, and the two upper ones to the ends of the spring on that side of the engine, so that the shackles will either approach or recede from each other, according to the direction in which the handle is turned. As the shackles are made to approach each other, the weight of the engine will be thrown proportionably on to the spring, which, pressing down a prop upon the top step in the axle-box of the driving-wheel, will increase the adhesion of the wheel to the rail. The same apparatus is applied to both sides of the engine, and an arrangement is shown for preventing too much weight being thrown upon the wheels.

The second improvement is a new buffing apparatus. The inner end of a buffing-rod is keyed into a flanged socket, in which a piece of soft wood is fitted with its fibres at right angles to the buffer-rod; the socket works along a pair of guides affixed to the framing. The space between the socket and an abutment attached to the centre of the under side of the carriage is filled alternately with blocks of wood and elliptic springs, kept in their places by iron pins.

The third improvement is a break for railway carriages. In front of the carriage there is a vertical shaft and handle, having at its lower end a pinion which, by suitable gearing, works a number of levers, of which there are two to each wheel. Each of these levers

has two arms attached to it by joints; a spring plate extends between and is jointed to these arms. In front of the spring, a platted rope is secured to the arms, which, by turning the vertical shaft, is brought in contact with the periphery of the wheels, adapting itself thereto by means of the spring. A bevel pinion slides on the upper end of the vertical shaft, which, by means of a treadle, can be thrown into gear with another similar wheel on a crank-shaft, which works an apparatus by which air is pumped into a vessel on the top of the carriage, which is furnished with a whistle, by which a signal can be given to the engine-driver. The break and whistle can be worked together or separately, at the discretion of the guard.

The fourth improvement is a coupling chain for railway carriages, consisting of two shackles, through the inner ends of which two jointed tension-rods work; on the end of each rod a cross-head is fastened which works along the inside of the shackle. The spaces between the cross-heads and the inner end of the shackles is filled with spiral or elliptic springs, or these and pieces of wood, so as to form a coupling chain that will be elastic when pulled in the direction of its length.

The fifth improvement is a railway chair, cast with a space in the bottom, into which a piece of compressed oak or other hard wood is placed, and upon this the rail is seated; a space is also left in the inside cheek of the chair, in which a piece of compressed wood is inserted, and the wood key then driven in.

The sixth improvement consists in a new mode of constructing railway wheels, so as to be uniformly elastic in all parts of their periphery, and in the formation of an outer tire, separate and distinct from the inner tire; and also the construction of the flange and inner tire in one piece. The nave of the wheel is of cast iron with radial mortises, into which pieces of wood are pressed; the fibre in the centre of each piece being a portion of a radius of the wheel; the shoulder of these mortise pieces bear on pieces of wood, the fibre of which is at right angles to the plane of the wheel, and their extremities are secured by dovetailed pieces of wood. The wheel being turned in the lathe, the inner tire is shrunk on, with as much flange on the inside of it as the expansion will allow; it has also a flange to guide the wheel on the rail. The outside of the inner tire is then turned conical, with the greatest diameter to the outside of the wheel, and the outer tire of shear steel shrunk on.

A kind of hydraulic press, for pressing the mortise pieces into the nave of the wheel simultaneously is shown and described.

The claim is, 1. To the construction of apparatus, and its application, for increasing the adhesion of the driving wheels of locomotive engines on the rails, as described. 2. To the application of wood to buffing apparatus, in the manner described, and the combination therewith of elliptic or segment springs. 3. To the moveable arm of the break, and the flat spring in conjunction with them, and also the application of the platted rope, for the purposes of breaking. Also the combination of the whistle with the break in the manner described. 4. To the improved coupling chain, whether constructed altogether on the principle of the buffing apparatus, or with spiral springs, or partly on one principle and partly on the other. 5. The mode of constructing the iron part of the chair, and arranging the wooden portion of it, so that the rail is seated altogether in wood, and is completely insulated from the iron of the chair. 6. The combinations herein described, and the use of steel as well as of iron, in the manner of a separate and distinct tire, attached and removeable in the manner described; and also the construction of the flange and inner tire in one piece.

William Bridges Adams, of Porchester Terrace, Bayswater, Gentleman, *for certain improvements in the construction of wheeled carriages, and of certain appendages thereto.* Enrolment Office, June 28, 1841.

These improvements are twelve in number, and consist, firstly, in a mode of turning the hinder wheels of a four-wheeled carriage instead of the fore wheels, as is usual, when travelling round a curve in a road. For this purpose the axle of the hind-wheels is attached to a frame beneath the hind boot, turning on a pivot fixed to the under part of the carriage body; a horizontal bar extends forward from this frame, having a stud on its end which works in a slot in one end of a bar turning on a pivot at the centre. The splinter-bar is fixed to the front of the carriage, and has an opening through which the slotted bar projects, and is suitably formed to receive the end of a pole or shafts.

When the pole is turned in order to travel round a curve, the slotted end of the bar projects in the opposite direction, carrying with it the first bar by means of its stud, and causes the hind-wheels to be directed towards the outside of the curve to be traversed. The fore-axle is fixed to the springs so as always to be at right angles to the carriage body.

Secondly. In the application to each end of railway carriages of a bar with buffer heads,

which bars are attached by shifting fulcrum springs to the carriage. The springs are of the kind described in a former specification, or elliptic springs may be used. The springs at each end are connected by a traction-rod which slides through the sockets that connect the ends of the springs, but is prevented passing through by knobs at each end. By this means the buffer springs will serve for traction or propulsion.

Thirdly. In a mode of guiding railway carriages round curves, by means of traction-rods. The two axles are each attached to a frame centrally pivoted to an upper frame or to the body of the carriage; these frames are connected with traction-rods, arranged so as to act in a similar manner to the bars mentioned in the first improvement.

Fourthly. In a mode of enabling the axletrees to diverge from their parallelism on traversing curves by suspending the springs to which the axles are attached on scroll irons, on which they slide laterally, guided by traction-rods through a connecting bar. Also in constructing railway carriage bodies in separate frames and bolting them together.

Fifthly. In an improved mode of constructing the spring wheels formly patented, in which specification the spring spokes were described as hoops of steel, or other elastic material, perfectly independent of each other. In the present improvement they rest against and support each other, the lower ends being of a semi-circular form, which is continued until they touch, when they proceed in tangential lines to the nave, where they are secured. The space between them gradually increases until they reach the nave, which spaces may, if approved, be filled up by wooden wedges. The other extremities of the spokes are secured to wooden wedges which enter between the wooden felloes on which the spokes rest, and keep them firmly in their places in the tire.

Sixthly. In the application to the axles, &c., of wheel carriages, of leather, woollen, or other elastic washers armed with a surface of polished metal, against which the end of the axle-box works. By this means the required elasticity is obtained while the friction, being confined to the metallic surface, the elastic packing is preserved, and loss of oil prevented.

Seventhly. In the application to wheel carriages of spring breaks and guards, the upper ends of which are fastened above the wheels, and the lower ends are attached to the breaks a short distance above the ground. Also in the application to railway carriages of self-acting breaks suspended from the front of the carriage, and connected with the buffer bar mentioned in the second improvement. When the progress of the engine is retarded by shutting off the steam and applying its breaks, it resists the momentum of the train, and forcing their buffer bars into contact with each other, applies the breaks, and so stops the train.

Eighthly. In an improved drag-staff divided into two parts, one having a short iron rod, and the other a hole in which it works; these two parts are joined together by an elliptic spring having holes in it through which the rod works. When the carriage to which this drag-staff is applied is stopped in the middle of an ascent to rest the horses, the weight of the carriage will be supported by the staff and the spring compressed; but when the motion of the horses is recommenced, the spring will expand and assist the horses to overcome the vis inertia of the carriage.

Ninthly. In the application to such carriages as are moved by internal power, of radius bars, or frames instead of the usual axle guide, so that the wheels may be kept parallel with the line of progress. These radius bars are mounted at one end upon suitable axles, while the axle passes through the other end, and is attached by springs to the carriage. The axle is thus capable of a slight vertical movement, but is prevented from moving laterally by the radius bars, which sustain alternately the thrust and pull of the moving power through the agency of a band or toothed gearing.

Tenthly. In constructing a two-wheeled omnibus suspended within a deep cranked axle, so as to possess a pendulous balancing power, the centre of the wheel being the point of suspension. There is a spring skid at each end to support the body in the event of the horses falling, &c. For light loads one horse is attached to the omnibus by a pair of shafts, but for heavier loads a pole is substituted, and a pair of horses attached, curricle fashion.

Eleventhly. In the application to wheel carriages of shifting fulcrum springs in combination with radius bars, pressing on them as bearing springs, and also as buffer springs for railway carriages. Also in improved modes of supporting carriage frames on bowed springs.

Twelfthly. In the application to railway carriages of shackle-braces, made of fibrous yarn, or metallic wire, in a continuous skein, and banded together by a warm mixture of resin and oil, or other similar compound.

JOHN GRYLLS, OF PORTSEA, SHIPWRIGHT, *for improvements in machinery used in raising or lowering weights*. Enrolment Office, June 30, 1841.

The improvements included under this not very appropriate title are six in number, and are as follows :—

Firstly. Instead of making the "whelps" of windlasses of the usual inverted curved form, the projecting surface of each "whelp" is formed of inclined planes, so as to avoid the surging or fleeting of the cable.

Secondly. Capstans are adapted to receive an increased number of bars, by being constructed with a double head; consequently, twice the usual number of men can be employed to turn them.

Thirdly. The bodies or barrels of capstans, instead of being made of one piece of wood, are built of four pieces, fastened together by bolts and dowels, hooped at top and bottom; in which manner a barrel of any required size may be constructed.

Fourthly. For the purpose of readily connecting or disconnecting an upper from a lower capstan, they are connected by a vertical shaft, the ends of which terminate respectively in the top of the upper capstan and in the bottom of the lower one, to which it is fastened; on this shaft, in the lower part of the upper capstan, there is a collar, and above it a plate fastened to the body of the capstan, with two holes, through which two sliding bolts pass. By causing these two bolts to descend into two recesses in the collar, the upper capstan is connected to and moves with the lower one; but when the sliding bolts are raised out of these recesses, the upper capstan is set free, and turns round the vertical shaft independent of the lower one.

Fifthly. For more conveniently riding ships and giving out the cable, an apparatus is placed between the upper and main decks of a vessel, which consists of a barrel provided with "whelps" similar to a capstan, moving freely round a spindle, the upper end of which turns in a bearing under the upper deck, carried by two of the ship's beams, being capable of rising and falling in that bearing; a screw is cut in the lower end of the spindle, which enters a screw block in the main deck, around which block is a circular plate affixed to the deck. A pall rim moves on this plate, which, when desired, may become friction surfaces for holding the barrel from moving round the spindle; the palls move round the pall rim when giving out the cable, but when heaving it in, the pall rim is held fast by the palls. In order to stop the barrel and running out of the cable, a circular plate on the collar of the spindle is turned by bars, which causes the spindle to descend, and its collar pressing on the top of the barrel, carries that down also, which brings the pall rim and circular plate in close contact, the friction of which stops the barrel from turning.

Sixthly. The stoppers for cables are formed of two parallel surfaces of oak, having grooves in their working surfaces, lined with iron, for the passage of the cable. These surfaces are connected together by parallel bars, like a parallel rule, and are made to approach to or recede from one another, (and thereby hold on to the cable or allow it to pass freely,) by a forked lever having a slot in each of its forks; in these slots two pins, projecting from the sides of the parallel surfaces, work.

The claim is, 1. To the improved construction or form of whelps applied to barrels for raising and lowering weights. 2. To the mode of constructing capstans with heads suitable for receiving an increased number of bars. 3. To the mode of constructing or building the bodies or barrels of large capstans by means of sector pieces. 4. To the mode of connecting or disconnecting the upper from the lower capstan. 5. To the mode of constructing apparatus to be used for riding ships, and for more conveniently governing the giving out of the cable. 6. To the mode of constructing stoppers by parallel surfaces.

William Hensman, of Woburn, Bedfordshire, Machinist, *for improvements in ploughs*.—Enrolment Office, June 30, 1841.

This invention consists of two methods of applying coulters to ploughs so as to admit of easy adjustment. In the first mode, a projection is formed on one side of the plough-beam, serving as a fulcrum on which the coulter moves; on the other side is a plate which partly embraces the beam. Through this plate the end of two eye-bolts pass, and are secured by nuts, and through the eyes of these bolts the coulter is passed, resting against the projection before noticed; by tightening the nut of the upper or lower eye-bolt, the end of the coulter will be made to advance towards, or recede from the land side of the furrow. In the second arrangement, the projection instead of being on the beam, is on a plate applied to one side of the beam through which the eye-bolts pass; the lower bolt also passing through the beam, serves as an axis to the plate. An adjusting screw is attached to the end of the plate by a pin-joint, its upper end passes through a projection in the beam, and has a nut screwed on to it. In this arrangement the coulter has two adjustments, viz., it can be made to advance to, or recede from, the land side of the furrow by the eye-bolts and screw-nuts; and it can also be made to advance to or recede from the front of the plough by raising the end of the plate, which is effected by turning the nut on the adjusting screw.

The claim is, 1. To the mode of adjusting coulters of ploughs by the combined means of a projection, and screws or eye-bolts. 2. To the mode of adjusting coult-

ers by means of a plate, and adjusting and holding screws when in combination with the projection and eye-bolts.

HENRY ADCOCK, OF WINSTANLEY, CIVIL ENGINEER, *for improvements in the means or apparatus for condensing, concentrating and evaporating aeriform and other fluids.*—Enrolment Office, June 30, 1841.

Within an air-tight chamber a spiral wheel revolves, the axis of which is hollow, and is supported in three steps or bearings, that end which turns in the back step being closed. One step is affixed to the back of the chamber; the second is secured in an air-tight manner in the front of it; the third is placed a short distance in front of the latter, and supports the extremity of the hollow axis, as well as the end of a stationary horizontal pipe which is in contact with it, and communicating at its other end with the lower part of a vertical pipe, the upper end of which terminates in a chamber above, from which a smaller pipe descends into the air-tight chamber. Three grooves are formed in the second and third steps, with three corresponding grooves in the exterior of the hollow axle, which are filled with tallow, or oil and tallow, so as to prevent the escape of the fluids to be condensed, and to do away with the greater part of the friction. The first chamber is filled up to the centre of the hollow axle with water, or other condensing fluid, while the aeriform substances to be condensed are introduced into the upper part of the chamber, and occupy the space above the water. The spiral wheel being caused to revolve, during one half of its revolution takes in the fluid to be condensed, and during the other half, the water, or other condensing agent. Whatever is taken in by the wheel passes towards the centre, where it enters the hollow axis, and as the capacity of the spirals decreases from the periphery some portion of the water flows back from the several spirals, so that the aeriform or other fluids are exposed to continuous showers of water as it moves towards the centre, and when it reaches that point it passes through, or mixes with, a solid mass of water which flows along the horizontal pipe, and up the vertical pipe to the upper chamber, from whence it descends into the air-tight chamber again.

By re-working, (either with, or without pressure,) the water or other condensing agent, with further quantities of the fluid to be condensed, concentration to a certain extent is effected, which may be still further extended by the application of heat.

The same apparatus is also used for evaporating; the liquid to be evaporated occupying the place of the condensing agent, and a current of heated air being admitted to the upper part of the chamber, so that the wheel alternately takes in the liquid to be evaporated and the heated air.

When a clammy or glutinous fluid is to be evaporated, it is placed in long shallow troughs fitted with air-tight covers which leave a small space between the surface of the fluid and the covers; a current of heated air is passed through this space over the surface of the fluid, thereby effecting a rapid evaporization which may be still farther expedited by applying fires beneath the troughs.

THOMAS ROBERT SEWELL, OF CARRINGTON, NOTTINGHAM, LACE MANUFACTURER, *for certain improvements in obtaining carbonic acid from certain mineral substances.*—Petty Bag Office, June 30, 1841.

In order to obtain comparatively pure carbonic acid gas at a small expense, various mineral substances containing a large proportion of carbonate of magnesia, (such as bitter spar, dolomite, and magnesian limestone,) as also the iron-stone, which contains a large proportion of carbonate of iron, are employed. These minerals are placed in a retort and heated to redness; when the carbonic acid gas is given off, and being received into an hydraulic main is led into a purifier containing coarse sand or gravel moistened with water, or with a diluted solution of soda, from whence it passes into an ordinary gasometer.

The claim is to the use of the above-mentioned minerals, when heated in such vessels as will admit of the carbonic acid being conducted and collected into receivers as above described.

HENRY SCOTT, OF BROWNLOW STREET, BEDFORD ROW, SURGEON, *for improvements in the manufacture of ink or writing fluids.*—Enrolment Office, June 30, 1841.

To make 80 gallons of ink, 48 lbs. of logwood chips are soaked in soft water two days; they are then placed in an iron boiler with 80 gallons of soft water, and boiled for an hour and a half; the logwood chips are then taken out, and their place supplied by 48 lbs. of Aleppo galls in coarse powder, and the boiling continued for another half hour. This mixture is then removed from the fire, and allowed to remain for twenty-four hours, frequently stirring it; the clear liquor is then drawn off, and 40 lbs. of sulphate of iron in powder added to it, and stirred daily for a week; at the end of that time 4 gallons of vinegar are next added; 7½lbs. of gum arabic dissolved in water and strained are next added by degrees; and at the expiration of a few days 20 oz. concentrated nitrate of iron

is put into the mixture, which is allowed to stand until sufficiently black; the clear liquor is then poured off from the sediment and the following substances added to it:—

Half-a-pound of Spanish indigo is ground fine in the ink, and 3 lbs. of Prussian blue ground in water. Four ounces of gas-black (gas smoke deposited on glass) are ground in one ounce of nitrate of iron, and after remaining a few hours these substances are added to the ink, which is stirred daily for a week, and the clear liquor then drawn off for use.

The claim is for the application of nitrate of iron and gas black when combined with other suitable materials, in the manufacture of ink.

William Henry Kempton, of Pentonville, Gentleman, *for improvements in lamps.*—Enrolment Office, June 30, 1841.

These improvements consist in the mode of constructing glass chimneys to lamps. The chimney is contracted at its lower end by turning the edge inwards, and is supported by rods upon a ring above the wick of the lamp. Or the glass chimney may be supported upon a circular disc of metal having a diminished aperture in its centre, in which case the lower end of the chimney need not be contracted. By this arrangement the flame is supplied with air all round the wick above the point of combustion.

The claim is to the mode of applying the chimneys of lamps as above described.

Joseph Stubbs, of Warrington, Lancaster, File Manufacturer, *for certain improvements in the construction of screw-wrenches and spanners, for screwing and unscrewing nuts and bolts,* (a communication.)—Petty Bag Office, June 30, 1841.

The fixed chap, stem, and handle of the spanner are in one piece; the moveable chap slides in a slot in the stem. Parallel to the back of the stem a screw shaft is placed, one end being made fast to the fixed chap; the other after passing through a cylindrical opening in the head of the sliding chap, is fastened to the handle by a staple. There are two nuts, one before, the other behind the movable chap. In use, the sliding chap, being placed in the required position, is held there by screwing up the nuts on either side thereof.

The claim is to the movable chap sliding in a slot in the stem, the distance between the two chaps being regulated and determined by nuts, moving along a stationary threaded shaft.

William Newton, of Chancery-Lane, Civil Engineer, *for certain improvements in the rigging of ships and other navigable vessels.* (A communication.) Petty Bag Office, June 30, 1841.

These improvements consist in the employment of a peculiar kind of lever in combination with a sliding rack-bar, a ladder-chain, or a toothed wheel, by means of which the shrouds, &c. of ships may be tightened, the windlass worked, and heavy bodies moved or raised.

The shroud, &c. to be tightened, is attached to a ring on the end of a rack-bar, sliding in a frame and sheath, which is a rectangular iron box connected to the holdfast, to which the shroud is to be secured; the other end of the frame has a flap, or door, capable of rising on hinges to admit a lever, and in the sides of this end of the frame are two circular apertures, in which a circular pin is inserted and keyed, serving as the axis or fulcrum of the lever. The lever is a long bar with teeth, or indentations cut in its lower end, which take into the teeth of the rack-bar; and has a kidney-shaped slot near its lower end, for the reception of the fulcrum pin above mentioned.

The lever being placed with its teeth in those of the sliding rack-bar, the fulcrum pin occupying the upper part of the elongated slot, and pushed forward, its teeth will be withdrawn out of the rack-bar, the fulcrum pin being made to occupy the lower portion of the slot. If the lever is now drawn back, its teeth will engage the teeth of the sliding bar nearer towards its ring, than those which they previously entered into, the fulcrum pin again occupying the upper part of the slot. Force being now applied to the lever, it forces the sliding-bar forward into the sheath, thereby tightening the shroud; the sliding-bar is kept from sliding back by a dog, or pall falling into its teeth. A ladder chain may be used instead of the sliding rack-bar; or the lever may be employed to turn the windlass, by inserting its fulcrum-pin into the framing, and causing its teeth to take into a toothed wheel on the barrel of the windlass.

The claim is, 1. To the peculiar construction of the lever described, having teeth, or indentations at its end, and an elongated slot, or eye, to receive the fulcrum-bolt or axle, upon which the lever works; which elongated slot or eye may be curved, and will answer best if of a beam or kidney shape, allowing the lever to act upon the rack, wheel, or chain, in one direction, and to pass over free in the opposite direction.

2. To the boxes or frames for the lever slide or chain to work in, with their appendages.

3. To the sliding rack-bar, or the toothed wheel, or the articulated chain, in connection with the lever as described, for drawing up to tension the shrouds of a vessel, or for winding a chain or rope upon a barrel, or for raising or moving heavy weights.

Joseph Parkes, of Birmingham, Button Manufacturer, *for improvements in the manufacture of covered buttons.*—Enrolment Office, June 30, 1841.

These improvements consist in manufacturing buttons covered with horn. The horn in a thin state, called lantern leaf, is cut into circular discs with scolloped edges; a collet is provided for each button, similar to what is used in the "Sanders" plan of manufacturing Florentine, and other covered buttons. A lower covering die, being heated, is placed in a suitable press, and above it a large punch; the disc of horn is laid upon the die, and the shape or mould of the button with its shank placed above it. A blow is then struck which presses the parts into the concave bottom of the lower die, turning up the edges of the horn all round the shape. The large punch being raised, the lower end of a tube, which is bell-mouthed, is introduced into the die above the button, and passes down between the scolloped edges of the horn, and the interior of the die; within this tube, near its lower end, the collet is placed, and above the collet there is a small punch; over the whole a hollow block is placed, the edges of which rest on the top of the tube, but the upper part of its interior is some distance above the top of the small punch. The large punch being brought down upon the hollow block causes the bell-mouthed tube to press the scolloped edges of the horn on to the button. The hollow block is then removed, and the large punch again brought down on to the small punch, causing it to force the points of the collet through the scolloped edges of the horn into the button, thereby fastening the disc to its face. The button is afterwards taken to the finishing dies and pressed into shape, and then finished off by *edging* it in a lathe.

The claim is to the mode of manufacturing covered buttons by the application of horn as a covering material.

Henry Bessemer, of Percival Street, Clerkenwell, *for a new mode of checking the speed of, or stopping railroad carriages under certain circumstances.*—Rolls Chapel Office, July 6, 1841.

The invention which forms the subject of this patent is a self-acting break so constructed as to be brought into immediate action by any diminution of the regulated distance between the locomotive engine and the train of carriages. The moment the engine ceases to pull, whether from accident or design, the breaks begin to produce their retarding influences.

A train is shown connected to the engine by a "fore separation rope," and drawing after it a truck by a "hind separation rope." In the first carriage of the train there is a reservoir of condensed air supplied by a pump keyed on one of the axles, and worked by a crank on the other; a valve opens or closes the communication between the reservoir and a cylinder, as well as between the latter and the atmosphere; in the cylinder there is a piston, which when pressed down by the condensed air acts upon jointed rods so as to force the breaks into contact with the wheels. To remove the breaks, a communication is opened between the cylinder and the atmosphere, when a spring draws back the breaks into their original position.

The situation of the slide-valve, and consequently the presence or absence of pressure on the piston and breaks, depends on the tightness or slackness of the "forc separation rope," which is attached to a sliding spring bar having two flanches or shoulders, one of which, when pulled, bears against the frame of the carriage; a strong spiral spring wheel abuts against the second shoulder, and forces it back from the carriage frame in the opposite direction as soon as the pull ceases. When the rope is in a state of tension, the slide valve is drawn out and a communication formed between the break cylinders and the atmosphere, whereby the breaks are kept off the wheels. But when from any cause the traction ceases, and the rope becomes slack, the slide valve is forced back, and the communication between the condensed air and the break-cylinders opened, which stops the train. Each carriage has its own break cylinders connected with the condensed air vessel in the first carriage by suitable pipes.

To guard against the consequences of the engine striking a fixed obstacle, a rod projects from an aperture in the centre of each buffer, which in meeting with any obstacle is forced back, and reverses the valves of the engine.

In order to take up the slack of the rope when the engine is employed in breaking the trains, the fore end of the rope is attached to a pulley on a shaft lying across the tender; a drum on each end of this shaft is brought into contact for the time with the tire of the tender-wheel, and as the tender runs backward, its pulley winds up the rope.

The rear guard truck is drawn after the train by the hind separation rope, which is attached to an eye jointed to a couple of rods, which are deflected by the action of a spring and force the breaks upon the truck wheels; but the force of traction draws these rods into a horizontal position, and raises the breaks from off the wheels. As soon as the tension of the rope ceases, the spring again forces the breaks into action.

Joseph Hall, of Cambridge, Grocer and Draper, *for a seed and dust disperser, which is particularly applicable to the free-*

*ing of corn and other plants from insects.* Enrolment Office, July 14, 1841.

This invention consists of a machine or apparatus, adapted either for the dispersion of seed alone, or of dust alone, or the two in combination. A framed carriage is mounted on a pair of running wheels, to the nave of one of which a spur-wheel is fixed; when the machine is used as a dust disperser, a case containing a large pair of bellows is placed across the front part of the carriage, and the dust-box is placed behind it. The upper compartment of the bellows or wind-chest is compressed by two springs, and the bellows are worked by a lever, connected by a rod to a crank pin on the edge of a pinion, driven by the spur-wheel before mentioned. The dust-box is furnished with six or any other approved number of descending tubes or feeders, and has a cranked axle passing through its centre, working in suitable bearings, and having at one end a pinion which takes into the spur-wheel on the nave of the running wheel; six slight iron rods (i. e. one to every feeder) are suspended from the cranked shaft, and have inserted into them, pieces of stout wire bent into the form of a figure 8, or some other suitable projecting pieces, for the purpose of agitating the dust as it passes down the feeders. At the lower part of the feeders there are two openings directly opposite to each other; the one in front for attaching the windpipe of the bellows, the other for the insertion of the disperser or nosel, which may be of a conical or other approved form turned upwards, and terminates in a short screwed tube; a socket with a female screw is attached to the feeder, and by screwing the socket of the nosel or disperser a greater or lesser distance into the feeding tube, the quantity of dust driven out by the action of the wind, and the force with which it is ejected, may be regulated. The machine being fitted with shafts may be drawn by men or horses, and motion being communicated from the running wheel to the bellows and to the agitators in the dust-box, the lime, or other suitable dust in a light state is forcibly impelled in an upward direction against the under surfaces of the leaves or plants with such force as to remove or destroy any insects that may be therein.

When the machine is to be used as a dust and seed disperser, (or drill,) the dust-box and bellows are removed from the carriage frame, and a dust and seed-box fitted in their place, containing two parallel axles upon which six or more scoops or cup-wheels are arranged at regular intervals. The lower portion of the box beneath these axles is divided into a number of narrow cells within which one of the cup-wheels revolves; the box is divided longitudinally by a movable wooden partition, from which metal plates descend to the bottom of the box, conforming to, but not touching the peripheries of the cup-wheels. The sides of the box above the scoop-wheels which form receptacles for the dust and seed, have inclined partitions which turn up by hinge joints towards the outer side, when the scoop-wheels are to be taken out or replaced. A series of openings in the inclined partitions, one immediately over each of the scoop-wheels, are closed or partially opened by a slide. The seed being placed in one of the receptacles, the dust with which it is to be mixed in the act of sowing is placed in the other. In front of each scoop-wheel, there is a vertical pipe with an oblique funnel for receiving the seed and dust from the scoop-wheels, and conveying it into a series of suspended cups or funnels, which conduct it to the ground. On the exterior of the box two spur-wheels are fixed on the axles of the scoops, which receive motion from the spur-wheel on the nave of the running wheel, their contact being regulated by a suspending screw, by which the gudgeons of the dust and seed-box are supported. There is a lever at the back of the machine, by which the machinery can be thrown out of gear when it is desirable temporarily to suspend its operation, as in turning round, crossing roads, &c. When thus employed, the carriage is fitted with an iron swing frame, consisting of two semicircular sides, connected together at a distance equal to the width of the machine by bolts; this swing frame is pierced all round with square holes. At the lower part of the segment, a heavy roller in three parts is fitted by a bolt passing through it, and secured outside the frame by nuts. In front of this roller, and similarly fitted, there are six coulters fixed at intervals corresponding with the distances of the scoop-wheels; these coulters are wedge-shaped, with an opening in the hinder part of the wedge, through which the tube of the last suspended funnel is inserted, so as to deposit the dust and seed in the furrow prepared for it by the coulter. A corresponding number of rakes are placed between the coulters to turn over the ground and cover up the seed as it is deposited. A piece of scantling, which being continued forms the shaft, has a second piece attached to it, so as to allow the swing frame to play freely between them; a bolt is passed through the farther ends of the scantlings, and through one of the holes at the back of the segment, while a long bolt with nuts and projecting ends is inserted in one of the front holes; these projections come down upon the shafts,

**and stop the frame at any required inclination. The swing frame being thus attached to the shafts, the latter are fastened to the carriage by bolts passing through side-irons; and the frame being thus drawn from the farther extremity, the coulters and rakes are forced into the ground to any required depth, as regulated by the position of the stops. The coulter is attached to the shafts by a chain, so that if the carriage is backed, the coulters, &c., are drawn out of the ground, and the chain being hooked on the frame, they will remain suspended when the machine is again moved forward. On removing the dust and seed-box, the carriage with the rakes, forming a powerful harrow and scarifier—or, with the rakes and part of the coulters removed, forming a scarifier and roller—or with the roller only, may be employed with advantage.**

***Intending Patentees, or Patentees of unspecified inventions, may have every needful information and assistance on moderate terms by application to the Office of this Journal, where also may be consulted the only Complete Registry extant of Patents from the earliest period (A.D. 1617,) to the present time.***

## NOTES AND NOTICES.

*Fresh Water from Sea-water.*—Admiral Baudin and other officers, specially appointed for the purpose, have recently examined M. Lallier's apparatus for converting sea-water into fresh. The apparatus submitted to them was large enough for a vessel of 500 tons, and is composed of a cook's range, with appendages for distilling and filtering: the space which it requires does not exceed that of a customary range for ships' use; and as the apparatus itself admits of being applied to boiling purposes, it can scarcely be considered as an extra appendage. The mechanism is of so simple a description, that a common ship's cook may superintend the whole process. In eight hours' time, thirty gallons of sea-water were distilled, at an expense of eighty-two pounds of coal; the produce was equal in quality to the finest spring water, and the meats and vegetables cooked with it differed nowise in flavour from what they would have been, had they been cooked with water from the Seine. The invention promises to become of much importance in navigation; and orders have been issued to give it a trial on a large scale on board of some of the ships on service.—*United Service Journal.*

*Franklin's Printing Press.*—Mr. Harrild, of 11, Great Distaff-lane, Friday-street, Cheapside, has the identical printing press at which Dr. Franklin worked when a journeyman printer in London. It is made mostly of wood; had a bed of stone, instead of iron, on which the types were placed. It has a copper plate fixed on it, with an inscription setting forth its history; and goes on to state, that, forty years after the Doctor worked at the press, he revisited London on a political mission, and went to the office where this press was, and stated to the men using it, that forty years before he had worked at the same press—and treated them with beer.

*New Patent Britzska Head.*—A new britzska has just been built by Messrs. Hastwick and Bean, of this town, with a projecting head, the invention of Mr. N. I. Holloway, of London. We understand that this is but the third which has been made; and the advantages beyond any other kind of head are, that the whole of the apparatus are connected, and by a simple removal of the two front bows to the opposite side of the doors, the interior is formed of equal size to a chariot, and another simple movement makes it equal to a landau. We think there is much merit in the invention, and wish the patentee success.—*Eastern Counties Herald.*

*Solar Eclipse.*—An eclipse of the sun will take place to-morrow, (July 18,) which will be visible all over Scotland, and part of England. The time, as calculated for the observatory at Durham, is, apparent conjunction in R A 2h. 16m. 30s. Eclipse begins 2h. 31m. 14s. Greatest obscuration, 2h. 45m. 31s. End, 3h. 0m. 5s.

*The Cadogan Chain Pier, Chelsea.*—Earl Cadogan, the lord of the manor, has erected a handsome and convenient pier for steam-boat passengers, on a novel construction, at an expense of between 3,000*l.* and 4,000*l.* This erection was constructed by Mr. Cubitt, from the design and under the direction of Mr. Handford, the surveyor and architect of the manor. The pier is situated in the mall of Cheyne-walk, the most beautiful part of Chelsea, and forms one of the most interesting objects of the place. In the course of a few weeks the pier will be open to the public.

*Improved Locomotive.*—Messrs. George and John Rennie have set a locomotive, the *Mazeppa*, on the Great Western Railway, of an improved construction. On Wednesday, it took a load of 13 carriages between London and Chippenham, a distance of 93 miles, in 3 hours and 43 minutes, or in three hours travelling time, exclusive of stoppages, that is, at the rate of 31 miles per hour, and consumed only from 30 to 31 lbs. of coke per mile. Some of the other engines, it is stated, use 60 to 64 lbs.—*Cambr.*

*Anglo-Turkey Carpets.*—A correspondent has suggested to us that an extensive field of employment might be opened in this country, by manufacturing carpets of a fabric similar to those hitherto imported from Turkey and Persia. He considers it probable, that from our superior manufacturing skill, we might soon not only supply our own demands, but also become considerable exporters of this article. The looms, as well as the mode of working them, are described as being very simple and capable of being wrought by females.

*Improved Hour Glass.*—At the Royal Dublin Society's recent exhibition of Irish manufactures, a model of an improvement on the hour glass, invented by Christopher M'Dermott, of Irishtown, was shown. The sand, in place of passing silently away, strikes a bell upon its exit, which intimates that the period for which the glass was timed has expired, and gives notice to turn it. The sand, as it runs, divides its time on a dial affixed to the instrument, so that if the glass be timed for an hour, the minutes will be marked on the dial as the sand passes. Whether this improved sand glass be required at lecture or music practice, bakehouses or on shipboard, its extreme usefulness will be apparent; and if introduced into the drawing-room or study, it will be found both ornamental and useful—at once doing away with the small sand glasses used for dividing minor time.

*Errata.*—In the list of English patents in our last volume, page 480, first column at bottom, for "*certain improvements in machinery for apparatus,*" read "*certain improvements in machinery or apparatus for preparing cotton and other fibrous substances for spinning.*"

*Typ. Errata* in "The Calculator," No. 11, page 346, first column, at middle, for "but," read "put."
Line 12, from bottom, read "·73622."
— 7, ——————— "deduce."

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# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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## DESIGN FOR A STEAM VESSEL SUBMITTED TO THE PRESIDENT OF THE ROYAL SOCIETY IN 1808, BY MR. THOMAS OXLEY.

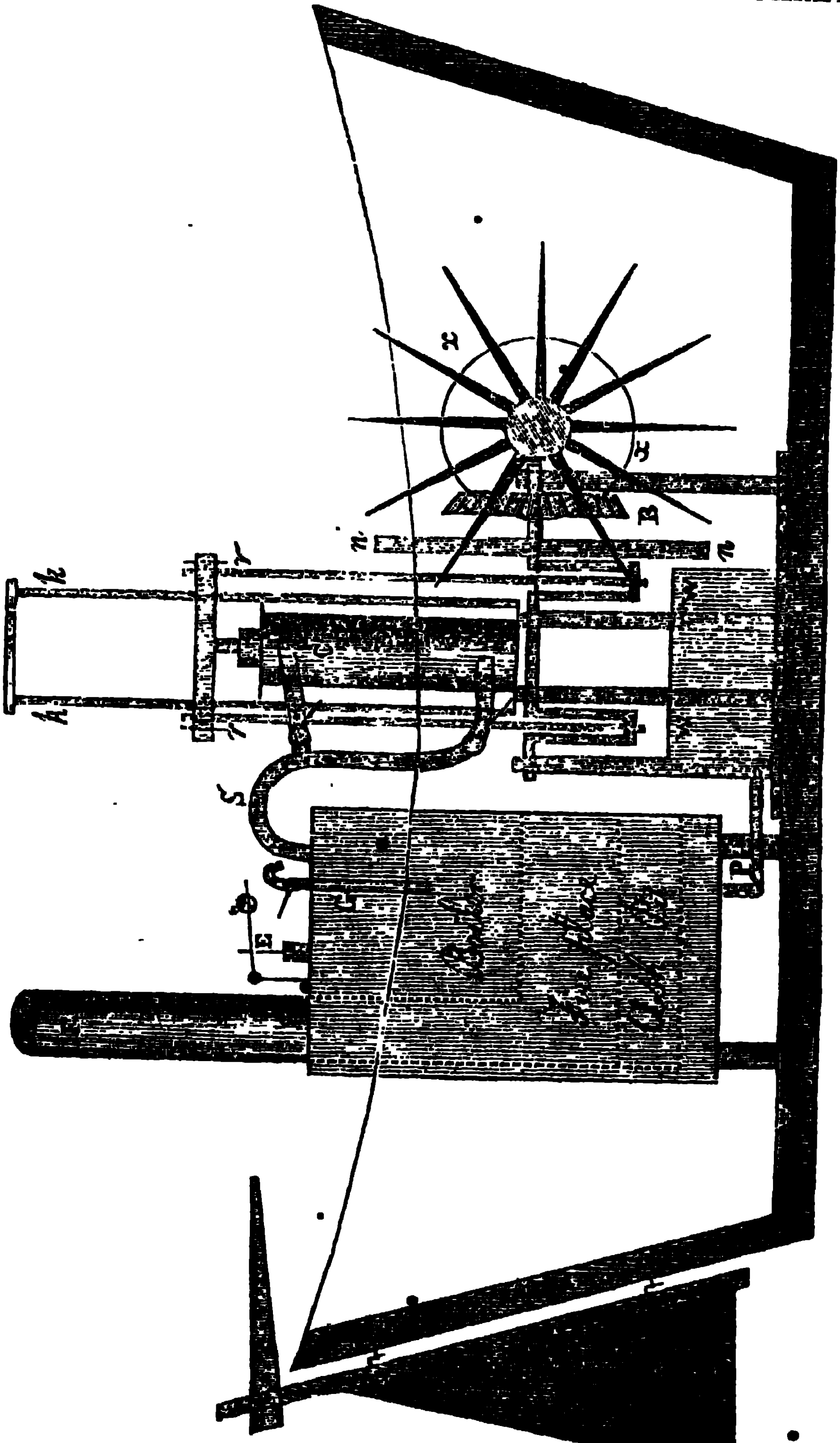


Fig. 1.

## NEW CONTRIBUTION TO THE HISTORY OF THE STEAM-ENGINE.

*Being the correspondence between Sir Joseph Banks, Baronet, President of the Royal Society, and Mr. Thomas Oxley; with the Plan of Steam Navigation Mr. Oxley forwarded to the Royal Society eight years before the general introduction of Steam Vessels in England.*

Sir,—Agreeably to my promise, I now forward for insertion, verbatim, the correspondence between myself and the late Sir Joseph Banks, President of the Royal Society of London, with fac-similes of the drawings of the plan that I then proposed for Steam Navigation, about eight years before Steam Vessels were seen on the Thames, or at least before they were brought into general use in England: and I hope your very numerous readers will have candour enough to bear in mind, that I had no example to copy from, and that the plan here submitted to their notice originated with myself, or in other words, was invented by me in the year 1807, and the very documents themselves prove the originality thereof. At that time I had never read, nor heard from any one, that Steam Navigation had even been thought of by any body before myself; in those days, that is to say, thirty-four years ago, there were no periodical publications on the Mechanical Sciences, or if there were, I can truly say that I never saw any of them; there was then no *Mechanics' Magazine*, nor anything similar. Here I must beg leave to remind your readers of the immense obligations, and of the debt of gratitude that the scientific public owe to the Editor and Publisher of the *Mechanics' Magazine*; for all the other cheap scientific periodicals, are nothing more than mere imitations of this very useful, original, and well-conducted work, which has stood its ground for eighteen years, and yet improves with age.

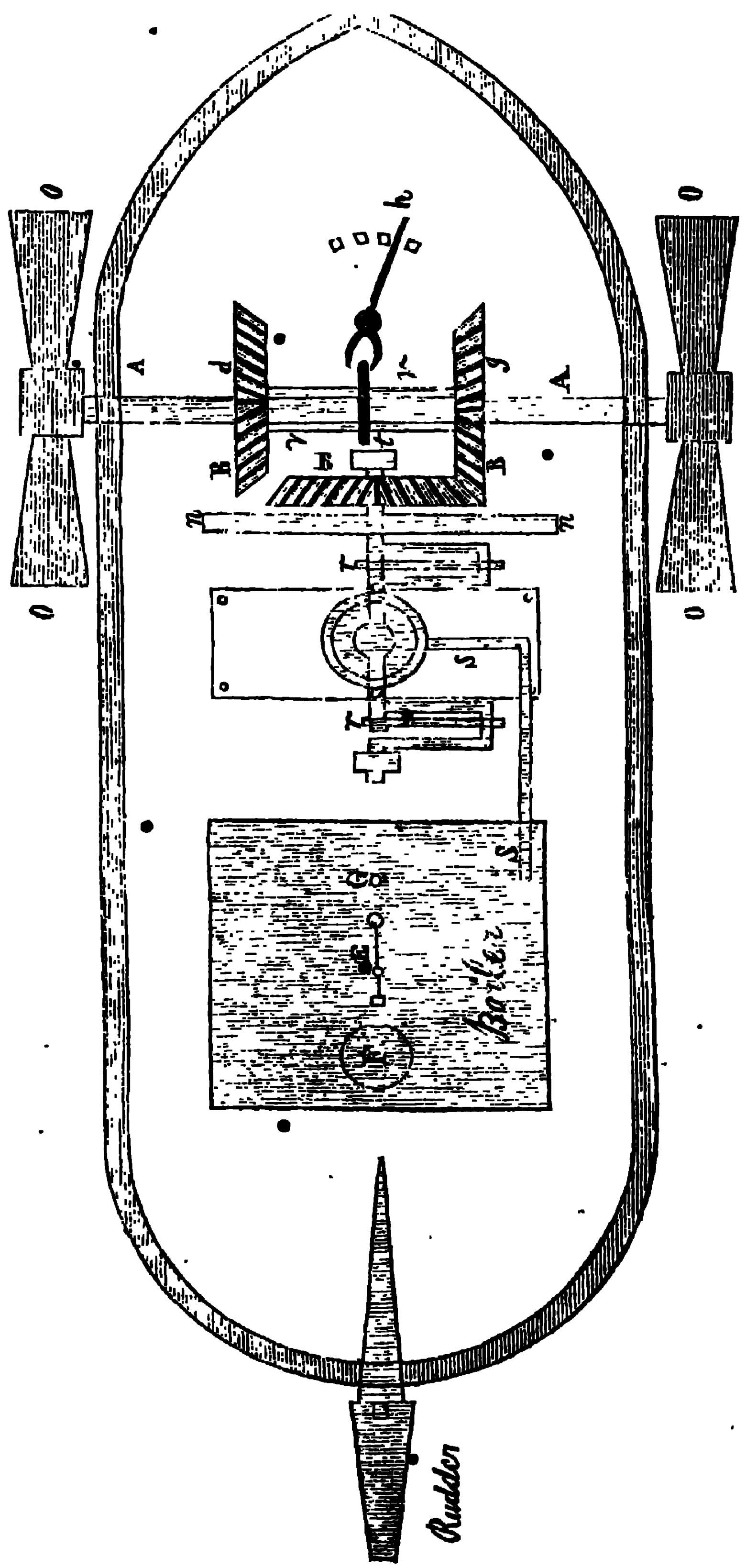
Had it not been for the enlightenment, and the vast impetus given to mechanical studies and pursuits by that celebrated work, many hundreds, I might say thousands, of clever mechanicians, stimulated by the *Mechanics' Magazine*, and many of whom have distinguished themselves and greatly benefited society by their improvements, would have remained in total ignorance of the mechanical sciences, but for the information, and I may add, scientific inspiration which they derived from its pages. In short, the *Mechanics' Magazine* has rendered those departments of science almost universal, and therefore, since mechanical knowledge has become so general and familiar, I must now remind your readers, that if they would judge justly, and award the merit that is due to the plan of Steam Navigation I invented thirty-four years ago, they must not judge by the present state of engineering; but endeavour to go back to the epoch of my invention, making proper allowances, and considering the then imperfect state of the mechanical sciences compared with what they are now. It is thus only that they can judge justly of the merits of the plan I forwarded to the Royal Society so many years ago. I must further remind them, that this is not one of the plans which I had formerly alluded to, as being superior to the engines, &c. on board the *Great Western* steam ship.

(*Copy of the letter to Sir Joseph Banks, &c.*)

"Right Honourable and Learned Sir,—Having often heard that ships are detained for several days, and sometimes for weeks, together from entering the desired port, or, of clearing out of the same, owing to the wind remaining contrary, and that ships are also frequently becalmed and unable to sail for many days in succession when on the wide ocean, I have within the last two or three years often thought that some mechanical means might be discovered which would completely obviate these difficulties, and accordingly, about twelve months ago, I sketched out a plan of machinery for this purpose, to be worked by a steam-engine inside, and revolving oars to be placed externally on each side of the ship or vessel in which the machinery may be fixed; and as I have never heard of such a thing being done by anybody else, I trust that the novelty of my invention will be a sufficient apology for my requesting your honour to present this communication and the accompanying plans to the notice of the Royal Society; for I have been told, that if my invention were approved of by that honourable and very learned body, that the government would then take up the matter, and assist me with ample means of bringing my plans into general use.

The drawings represent different sections of

Fig. 2.



a vessel intended to tow ships in and out of port when there is no wind for them to use their sails, or when the wind or tide is contrary. The same kind of steam-engine and machinery being properly fixed in a ship, or large vessel, would enable it to go forward on its voyage when becalmed for want of wind, and so help it into the trade winds, or proper current. As it is well known, if a ship had the means to be worked onward for two or three days, she might get out of the place that is becalmed, and by that means gain much in time and escape many dangers, and were my plan to be adopted, a ship then never need stand still, for when there was no wind, or when there was a contrary wind, the machinery would carry her forward, and when the wind favoured, the machinery could be stopped, and she could then use her sails, so that she would always be progressing to her destination.

"Anxiously, but most respectfully hoping to hear that my invention meets with your approbation, and that of the Illustrious Society over which you preside, with so much honour to yourself, and such great benefit to literature and the arts and sciences,

"Most Honourable and Learned Sir, I remain your very obedient humble servant.

"THOMAS OXLEY.

"St. John-street, Clerkenwell, Sept. 19, 1808.

"To the Right Honourable Sir Joseph Banks, Baronet, President of the Royal Society, &c. &c."

*Description of the Drawings of a Plan for moving Ships in a calm, or of sailing by means of a Steam Engine and Revolving Oars.*

Fig. 1, (see front page,) is a bird's-eye-view of the ship, or vessel with the machinery therein. In which, S S, represents the steam pipe; C, the cylinder; B B B, the bevil wheels; O O, the oars; *h*, the handle, or lever to throw the wheels in and out of gear, and to reverse the motion of the revolving oars without stopping the engine. The dotted square is the iron platform which supports the cylinder, &c.; *r r*, rods to connect the motion with the cranks and piston rod. E, the escape valve; W W, the condenser, water pumps, &c.; P, pipe to supply the boiler from the force-pump in W W; F, the chimney, and G the water gauge; *n n*, the fly-wheel; *x x*, the outline of the bevel wheels; B *g* and B *d*, serving also to represent the iron braces which support and keep the oars in their proper places.

Fig. 2, in this drawing the same letters refer to the same parts of the machinery as in fig. 1, only some things, as the lever, or handle *h*, are omitted, to prevent confusion in the delineation.

By looking at these drawings, the manner of the engines, acting will be easily understood; to the top of the piston rod is fixed an arm, or cross-bar of iron, which slides up and down two upright iron rods *k k*; near the ends of this bar is fixed two long rods of iron with freedom to vibrate thereon; the end of each rod *r r*, is fitted in like manner to a double crank, so that by the rising and falling of the piston in the cylinder, the cranks are made to revolve, and thereby, the fly wheel *n n*, and also the bevel wheel B, being upon the same axle as the double crank are both turned thereby. The bevel wheels B *d* and B *g* are fixed upon a square iron tube or socket *v v*, of which the circular collar *t* forms a part; and this socket, and the two bevel wheels upon it, slide backwards and forward on the large axle A A, which carries round the revolving oars. Now it is plain, that if we press the lever *h* against the circular collar *t*, we can place the two bevel wheels B *d* and B *g*, so as neither of them will touch the bevel wheel B, and that we can thereby stop the progress of the vessel in a moment, and that without stopping the engine; and it will also be seen, that, as represented in the drawing, fig. 1, the bevel wheel B *g* is in gear with the bevel wheel B, the vessel is going forward, but by means of the lever *h*, and the circular collar *t*, we can bring the bevel wheel B *d* in contact with the wheel B, the motion of the revolving oars is instantly reversed, and thereby, that of the ship or vessel also.

In reply to the foregoing communication on the subject of Navigation by Steam, Sir Joseph Banks sent me the following reply, dated—

"Revesly Abbey, October 21, 1808.

"Sir,—I have received your Letter respecting a Contrivance for moving a Ship in a Calm by means of Oars, of which you have given a full Description, with Drawings. Whether my own Judgment on matters of this Kind, founded on Some, the rest on much experience in naval matters, and acquired many years ago, is Sufficient to Enable me to Form a just opinion on matters of this nature, is for others to determine. Such as it is, however, I am sorry to

Say that it does not Lead me to any hopes of your Plan being more successful than many others, intended for the Purpose of moving ships by Oars, have been, all of which have entirely Fail'd.

"Under these Circumstances you will no doubt excuse me when I decline to undertake the office of Presenting your Paper to the Royal Society, as I am not in the Habit of Presenting to that body matters of any kind that do not meet my full approbation.

"I beg leave also to Suggest to You, that as the Board of Admiralty must Finally Judge of the merit of Your invention, and possess the means of bringing it to a Trial, which the Royal Society cannot do, it will therefore be better in the first instance to Communicate it to them, than to offer it to a Society that has no Superintendence over, or Concern with, maritime affairs.

"I am, Sir,

"Your Very Humble Servant,

"Jos: Banks.

"I will deliver your paper to any person who shall call for it, from you, at my house, in Soho-square, where I shall be in about three weeks."

"To Mr. Thomas Oxley, &c."

The preceding letter was the reply to my proposal of steam navigation, as written by the generally considered very learned President of the Royal Society of London, which I have given to your readers word for word, with the capital letters to almost every third or fourth word; but I have not given it according to his extraordinary system of orthography, lest they might think the mis-spellings were mine instead of his.

It might be thought by many persons, that such a reply, from such a (what the world calls) great man, would have so much damped my ardour in the pursuit of mechanical discoveries, that I should instantly have given up all thoughts of steam navigation, and every thing connected with the mechanical sciences, but I was not to be so easily discouraged; for I had been at Birmingham, and other places, where I had had opportunities of seeing steam-engines at work, though I had never seen any on the same plan as that sent in my communication to the Royal Society; and I had well considered in my own mind, that an agent so immensely powerful as the steam-engine might be successfully employed for many useful purposes, besides *rolling* and *slitting* of metal and *pumping water* out of the mines. With this strong conviction of the ultimate success of the application of steam to the purposes of navigation, on having carefully perused Sir Joseph Banks's letter, and having observed that he had not said therein what his objections were, nor stated the reasons why the attempts of other persons had failed, I immediately formed the resolution of going to see Sir Joseph himself, and hear from him what objections he could urge against the invention, and also learn from him what had been the causes of failure in others who had made similar attempts: for I believed that by a personal interview I could easily remove all objections from the mind of Sir Joseph, and fully convince him of the practicability of my invention, and, by showing him that I would avoid those causes of failure which had rendered others unsuccessful, induce the Honourable Baronet to reconsider my plan, and so have got his recommendation and that of the Royal Society; for I was then simple enough to think, that, under such patronage, my invention could not fail of making my fortune.

Accordingly, buoyed up with these flattering hopes, I went to the house in Soho-square, a day or two after the receipt of Sir Joseph Banks's letter, to ascertain, if possible, the very day when the Honourable Baronet would be in town; and I was very civilly told by those attending in his house, that something had occurred which would cause Sir Joseph to be in town about a fortnight sooner than had been expected; and that if I would call again in eight or nine days, I should be sure to see him. I went again at the stated time, and having given my name, was ushered into the study of this very learned personage; and, after I had made my obeisance to his honour, he addressed me in this manner: "I am glad to see you, Mr. Oxley. And so you are the young gentleman that fancies he could make ships to sail by means of steam-engines—very extraordinary, indeed, young gentleman—take a seat, and draw near me, for I shall feel very happy to convince you of the impracticability, I may say the impossibility, of yourself or any body else ever being able to sail or na-

vigate by steam machinery; it is quite useless to think of such a thing; and when I see a young man of ability engage in impracticable objects, I think it only my duty to persuade him not to devote his time and talents to such useless pursuits. Did you never hear of Mr. Jonathan Hulls, as an inventor of navigating by means of a steam-engine? And of a gentleman in North America, (I believe a Mr. Bushel, or Bushnell,) who did the same thing; and of Mr. Symington and Mr. Bell, in Scotland? These gentlemen, most of them, attempted the same sort of thing, years before you were born, and more latterly Earl Stanhope, and all of them have entirely failed in their attempts to navigate by steam machinery. And do you think, young gentleman, that you are *cleverer* than my noble and very talented friend, Earl Stanhope? Why, surely, you must have a very high opinion of your own abilities, if you think you could accomplish successfully what the other gentlemen, and also what my noble and very talented friend Earl Stanhope, had all of them entirely failed in. I can assure you, young gentleman, the thing is quite impossible; nothing need be better than the present mode of navigating, and I do assure you that nothing will ever be found out to supersede the use of sails."

Here Sir Joseph came to a full stop. I then thought it right to tell Sir Joseph, that, as I had never heard any thing about what had been done either by Earl Stanhope or the other gentlemen he had named, I therefore hoped Sir Joseph would not think that I was placing myself either in opposition to, or in competition with, either them or his noble and very talented friend Earl Stanhope; neither did I consider myself more clever than his noble and talented friend; but as Sir Joseph was so well acquainted with what they had done, I should esteem it a very great favour if Sir Joseph would inform me of it, and also explain to me his own objections against *sailing* by means of a steam-engine; for, though I did not think myself more clever than the gentlemen and the nobleman that Sir Joseph had mentioned, yet, as I had been long considering the subject, I believed that I might have thought of some things connected with it that they might not have thought of, and this gave me great hopes of success.

Sir Joseph then went into a pretty long detail of their experiments: he then observed, that he had explained to me what sort of machinery they had made use of: and then Sir Joseph, smiling, as I thought, sarcastically on me, said, "Well, young gentleman, as you were very desirous that I should state my objections against sailing by means of steam-engine machinery, these objections may be expressed in few words, but cannot be refuted; and it may not be amiss to remind you, that whatever approaches to, or is a near imitation of the works of nature, is very likely to succeed: this fact is very strongly exemplified by the old fashioned mode of sailing, which has been found to answer so well for very many centuries; it is perfectly natural, or at least a very strong approximation to the works of nature. You have only to recollect, young gentleman, the close resemblance that exists between a ship sailing on the ocean and a *bird* flying through the regions of the air; here you may at once see the strong analogy that exists between them: it is hardly necessary to tell you, that the sails of a ship and the wings of a bird are perfectly analogous. But what analogy can you find between the works of nature and making a ship sail by means of a steam-engine? I would say none, whatever: and I, in my capacity as President of the Royal Society, have had very many opportunities of seeing the plans of many curious inventions, and in that official capacity have come in contact with a vast number of ingenious and talented gentlemen, and would wish to give to every one the full credit of his ingenuity and talent, and would not have it thought that I speak any way in disparagement of the gentlemen and nobleman before mentioned as inventors of navigating by steam machinery, long before you invented your plan for the same purpose: it was, indeed, little, if any thing, better than a mechanical mania in them, to attempt a thing so contrary to nature in all its bearings. But, for those that come after them, warned by the example of their entire failure therein, I think it no better than complete madness to

make attempts in the same impracticable projects, as my objections will most clearly prove to you. In the first place, all machinery, and particularly machinery impelled by steam, requires to be kept very steady, and free from shaking; this can be done, as respects steam-engines fixed on the land, very easily, but upon the water it is impossible to do it. The rolling of the ship or vessel, occasioned by the waves, would shake and derange the machinery, and interrupt its motion; and, moreover, the last objection which I shall mention," said Sir Joseph, "is completely fatal to all such contrivances, and is, that the revolving oars, or that part of the machinery exposed to the action of the water, is instantly broken—it is snapped in pieces, like glass—it is quite impossible to make the machinery strong enough to resist the rough and boisterous waves of the ocean." I then told Sir Joseph, that his objections were certainly very strong ones; but that if others that had tried experiments had not made their machinery strong enough, I did not see that need prevent me, if my plan was brought into action, making my machinery so strong that the waves could not break it, nor derange it, more particularly as it would all, or the greatest part thereof, be made of iron; and though the motion of the waves was very strong, I thought that iron was still stronger, and if I did not make the machinery strong enough at the first experiment, I would afterwards increase the strength of it, two, three, or four times as much, until I had found out a degree of strength that could not be broken or injured by the rough waters of the ocean. At this point Sir Joseph Banks interrupted me, and began to repeat his objections, by saying, "You seem, young gentleman, to forget that, in making your machinery so very strong as you propose to do, that you would at the same time be making it very heavy, so heavy, indeed, that it would be a load of itself, a complete burden to the ship or vessel that had to carry it; in fact, to make it strong enough to resist, without being broken, the rough waters of the ocean, would so increase the weight of the machinery as to make the ship be in danger of sinking. So now, Mr. Oxley, I convince you that you are placed between the two horns of a dilemma; for if you would make the steam machinery sufficiently light, as not to be a burden to the vessel containing it, then it will not have sufficient power to impel the vessel forward, nor sufficient strength in its materials, but would very soon be broken in pieces by the waves; and on the contrary, if you made it so strong as not to be broken by the roughness of the water, then you fall on the other horn of the dilemma, and overburden and sink your vessel by the weight of the machinery. So you see, young gentleman, contrive as you will, your invention is completely impracticable, as were all the others for that purpose; and I would therefore earnestly advise you to abandon all thoughts of it, for it may be placed, along with the *perpetual motion*, among that class of objects that but too frequently raise up groundless expectations in ardent minds, only to mislead and ruin those that go in pursuit of them. I shall be glad to see you some other opportunity, if it be only to further dissuade you from so chimerical a project; so, for the present, I bid you good morning, Mr. Oxley."

In about three weeks after, I paid Sir Joseph Banks another morning visit, but I could not succeed in convincing him of the practicability of navigating by steam: he repeated his former objections with much warmth and earnestness; so, finding that it was quite hopeless to say any thing more about my invention, and wishing to finish our discourse and my visit pleasantly, I being then very conversant with chemistry, &c., asked Sir Joseph, how chemistry and galvanism were progressing? Then the honourable Baronet, with the greatest apparent kindness and condescension, immediately went into a minute explanation and encomium of the then recent brilliant discoveries, made by Sir Humphrey Davy, of the two new metals, sodium and potassium, and on many other interesting topics connected with the physical sciences; and I believe Sir Joseph felt pleasure in convincing me of his great intimacy with those departments of knowledge, for he conversed with me at least two hours on these subjects, in the most agreeable and pleasant

manner; and I can also believe that Sir Joseph might have been very clever in chemistry and natural history, but I cannot help thinking that he knew very little of the mechanical sciences. I then took my leave of Sir Joseph, thanking him for his great kindness and attention to me; and, as you may naturally think, Mr. Editor, inwardly regretting that I could not persuade him to think favourably of my invention.

Sir Joseph Banks's aristocratic bias is well known; my worthy friend, Sir T. C. Banks, Baronet, calls Sir Joseph "The great man with the little mind." Sir Joseph thought very little of those persons that did not possess either great wealth or a title, and had I been a lord, or a baronet, or somebody celebrated for his great wealth, he might, and no doubt would have thought better of my project, and probably would have recommended it to the notice of a still higher quarter. But I need not be surprised at the conduct of Sir Joseph Banks in asking me if I thought myself more clever than his "noble and talented friend Earl Stanhope," for we know that a man in humble circumstances, is almost always treated so by the titled and the wealthy; if he make a great discovery or find out a useful invention, nobody is willing to allow him the merit of it, and he meets with nothing but invidious comparisons, taunts and discouragement; and thus it has been with me for thirty-four years or more that I have been inventing, and have spent some hundreds of pounds in experiments; and although, as Colonel Randolph, ex-Governor of the State of Virginia, states in the letter of introduction he gave me on my leaving America, that "I was capable of rendering very useful services to society;" yet, from the apathy of some of my professed friends, and the envy of others of them for fear I should become richer than themselves, and some of them who were very wealthy, said, that if my plans were carried into execution, that I should soon become the wealthiest man in Europe; I was then proposing steam navigation between England and New York in twelve days, and on a far more economical plan than that now in use, whereby I could have furnished the merchants of England upwards of eighteen years ago with more cheap and expeditious transatlantic steam ships than they are now in possession of; but narrow-minded and illiberal feeling on the part of those persons who would have been as much, or more benefited than I could have been, has hitherto kept myself and my inventions in the back ground. But should it so happen through delay that all my inventions should be patented by other persons, I will at least claim the honour due to my inventions, for I will bestow fifty or sixty pounds in having the drawings of all my inventions lithographed with sufficient explanatory letter press, and bring forward therein convincing proofs that many of those engineers, and others who pride themselves upon their recent inventions and discoveries, were fifteen or twenty years behind me with the same, and that I am at least as much entitled to the appellation of Civil Engineer, as many who assume that honourable title.

I remain, Mr. Editor, most respectfully, your very obedient humble servant,

THOMAS OXLEY.

London, June 22, 1841.

P.S.—Your readers having always heard talk about paddles, or paddle-wheels, will wonder that neither Sir Joseph Banks nor myself, in our correspondence and conversation, ever made use of that name. Sir Joseph and I both called them oars, or revolving oars; I believe the word "paddle-wheel" was not known at that time; I think it was seven or eight years after before I heard it; and moreover, when the subject was mentioned, it was then more usual to say, "sailing by steam," than "navigating by steam;" it was not then thought improper to use the first of these expressions. There is another thing but right to mention, that Sir Joseph Banks, when speaking of the different inventors of steam navigation, or sailing by steam machinery, as he called it, said nothing to me about Mr. Fulton, the inventor or introducer of practical steam navigation in North America, which, I conclude, was either because little or nothing was known in England of the experiments that Mr. Fulton was making in America, or otherwise that Sir Joseph did not think much of that gentleman, or had some other motive for passing over Mr. F. in silence; indeed, when I was living in the United States of North America, I have been assured repeatedly by different English and Scotch gentlemen, that Mr. Bell, a Scotchman, and, I believe, engineer of Glasgow,

was the real directing genius of Mr. Fulton's steam-boats. But Mr. Fulton was rich, or comparatively so, having married a rich and eminent lady, the Chancellor Livingstone's sister, and Mr. Bell was poor, though talented, (I heard plenty about this when living at New York, in 1817,) and therefore Mr. Bell, being poor, would not receive the reward and honour due to his genius: the rich and titled only monopolize all the honours and other good things of this world. I know many curious secrets concerning noblemen and soi-distant noble inventors.

T. O.

London, June 22, 1841.

## PILBROW'S CONDENSING CYLINDER STEAM-ENGINE.

Sir,—The easiest way of explaining to "Machinator" the superior condenser vacuum of my engine to that of the ordinary kind, will be, to examine each of them separately under the same circumstances. Though I do not like to commence with assumptions, he will, I think, admit it to be indispensable in this instance; and until other experiments shall prove Mr. Watt wrong, it will be well to consider his experience the best guide for engineers. I will assume, therefore, that the best temperature for the injection water and condensement to leave the condenser is 93°, and the vacuum 27 inches of mercury, as established by him; now the question is, whether I can get 29 inches, without altering the temperature and quantity of the water. But before we go into this, we must see what the present condenser, under the above circumstances, is likely to contain—how much disengaged air, and how much vapour? The latter is found, by reference to the tables of the elastic force of steam at various temperatures, = 1·48 inches of mercury, or ¾ of a lb pressure; but, as we find the difference between the real state of the condenser (27 inches) and a perfect vacuum (the mean state of the atmosphere being 29·88 inches of mercury) is = 2·88 inches, or about 1·44 lbs., it proves that there is a quantity of disengaged air to the amount of 1·44 lbs. I should first observe, that, although the vapour due from the temperature of 93° is ¾ of a lb, yet this ¾ is not to be added to the strength of the disengaged gases, when that exceeds ¾ of a lb, because if the gases have more power than the temperature of the water, they press upon its surface, and prevent that vapour from rising, on the same principles as boiling water and the atmosphere. The 1·44 lbs. due from disengaged air or gas could not, however, amount to so much at one or each stroke of the engine, but only by accumulation, because the air-pump must take out, each stroke it makes, as much air and vapour, as well as water, as went in during two strokes of the engine, (considering, here, half a revolution a stroke). This is a *sine qua non*, or the engine would soon stop. The accumulation is therefore a disadvantage that must ever attend any intermediate condenser; while the condensing *in the common air-pump* would destroy half the effect nearly of the engine. The gases, or air, *must* necessarily accumulate, to a certain extent in the condenser, for the air-pump to take out as much as came in during the two strokes; because, if we say the capacity of the air-pump is the same as that of the condenser, then would this pump but take out half the condenser's contents of gases each stroke; so that the accumulation must be to the amount that shall bring the gases to double the amount of pressure due to two evacuations of the cylinder. The water does not interfere at present with the matter in question; I therefore omit any notice of it here, in order first to finish with the air, or gases, before we proceed. We have ascertained that the 1·44 lbs. which we find in the condenser, is due from the evacuation of two cylinders, and the accumulation, or what was left in the condenser, amounting to, as much again; therefore, what would be due from one evacuation of the cylinder without any accumulation, would be one-fourth of that amount $\left(\frac{1{\cdot}44}{4}\right)$ = ·36 of a lb, being rather more than one pound in favour of my engine, as relates to air, &c. As the quantity of disengaged air, and gases and water, in the end, is the same in both engines, the forcing that quantity out of the vacuum to the atmosphere will be the same in either engine, and the increments of the pressure upon the air-pump piston or bucket, will be the same

whatever the dimensions of that piston may be.

We have now seen that, as far as the gases are concerned, we can get 2 inches better vacuum; we will now return and consider the strength of the vapour, *per se*, and ascertain whether that can amount to more than the ·36 of a pound; if not, then we have, as I have before stated, one pound better vacuum in my condensing cylinder, than in the condenser of the present engines.

We have said that the condensement is to leave the condenser at 93°, that is, when it has absorbed all the caloric of the steam last thrown into the condensing cylinder. But this cannot be the case until the piston has finished its stroke, and urged the caloric into it: it is not to be supposed that the water in the condensing cylinder is 93° when the piston commences its return stroke, for a weak vapour will then fill the space; not a vapour = 93° or 1·18 inches of mercury; for this is the *ultimate* state, when this vapour, which now holds in suspension the caloric, which, when forced into the water will raise it to 93°.

This, perhaps, may be more plainly comprehended if we take it this way, for sake of illustration. Suppose the condensing cylinder has a small quantity of water lying at its bottom, at 93°, and that the piston of the same is resting upon that water; we now draw up the piston to the top of the cylinder. There would have been a perfect vacuum formed if there had not been water present, and that at 93°; a vapour therefore rises immediately from this water, and fills the space. But now that this vapour has arisen, and expanded into space, the temperature of the water cannot remain the same (93°): the vapour has carried off a great part of the caloric of the water, and the resistance or strength of the vapour is no longer equal to what is due to 93°. This temperature will not be found again until the piston has descended, and driven all this vapour back into the water, and then the resistance will be only the ¼ of a lb; therefore the strength of this vapour must be most insignificant, infinitely less than the other item of gases, viz., ·36 of a lb; for it is whem this vapour was thus expanded, that we have to take its initial strength: the mean resistance of this to the piston, in its passage and its condensement and expulsion, will, of course, be equal to the same quantity thrown from the present engines, and not interfering with the point in question.

I hope I have been explicit enough without being tedious, and that I have satisfactorily proved that I have not fallen into the error supposed. Having thought deeply on these subjects, I am aware how difficult it is to return to the first steps to explain concisely and simply enough to meet all capacities, as it is always my endeavour to do. I hope "Machinator," or any of your correspondents will therefore be candid enough to ask for further explanation, if I have not made myself understood, or it may be considered I am incapable of it. I must observe, that the possibility of getting a mean vacuum of more than 27½ inches, in the common engine has little to do with the subject before us, as that depends entirely upon other circumstances, viz.: the size of air-pump and condenser, the quantity, quality, and temperature of the water used, the perfection of the air-pump and condenser, and the stuffing of pistons, the tightness of joints, pipes and valves.

I am, Sir,

Yours very respectfully,

JAMES PILBROW.

Tottenham Green, July 13, 1841.

## SOLUTION OF I. O. N.'S 4TH MATHEMATICAL QUESTION, VOL. XXXII. P. 687.

Sir,—Let G and D represent the positions of the observatories of Greenwich and Dublin, P the elevated pole; bis[illegible] D G in H, and draw the great circle P H; H will be the place diametrically under the balloon; P H the complement of the latitude, and the angle H P G the measure of the longitude.

| | | | | |
|---|---|---|---|---|
| Lat. of Greenwich | 51° 28′ 39″ N. | Long. | 0° 0′ 0″ | |
| Dublin | 53 23 13 N. | " | 6 20 30 W. | |

In the spherical triangle G P D are given two sides and the included angle ∴ G D the distance between Greenwich and Dublin is by the common process of Sp. Trig. $= 4° \; 15' \; 44''$.

In the following solution, we shall make use of the theorem for finding P H, the demonstration for which is given in No. 902 of the Magazine, also, another new theorem we shall give for finding the angle G P H. It will, therefore, be first necessary to enunciate and demonstrate the truth of the theorem.

Referring to the annexed diagram, and


that D G is bisected in H, the theorem is, $\tan.\left(\frac{DPH-GPH}{2}\right) = \cot.\left(\frac{PG+PD}{2}\right).\tan.\left(\frac{PG-PD}{2}\right).\tan.\frac{DPG}{2}$.

*Demonstration.*

$\sin. PHG = \frac{\sin. PG.\sin. HPG}{\sin. HG}$

and $\sin. PHD = \frac{\sin. PD.\sin. HPD}{\sin. DH}$.

But sin. P H G = sin. P H D, and sin. H G = sin. H D; therefore, sin. P G sin. H P G = sin. P D sin. H P D ∴ sin. P G: sin. P D :: sin. H P D : sin. H P G by composition and division sin. P G + sin. P D : sin. P G — sin. P D :: sin. H P D + sin. H P G : sin. H P D — sin. H P G, that is, $\tan.\left(\frac{PG+PD}{2}\right) : \tan.\left(\frac{PG-PD}{2}\right) :: \tan.\frac{DPG}{2} : \tan.\left(\frac{HPD-HPG}{2}\right)$. Hence, $\tan.\left(\frac{HPD-HPG}{2}\right) = \cot.\left(\frac{PG+PD}{2}\right) \tan.\left(\frac{PG-PD}{2}\right).\tan.\frac{DPG}{2}$.

Wherefore, &c.

Q. E. D.

*Calculation.*

$\frac{PG+PD}{2} = 37°..34'.\;4''$ cos. 9·899072 cot. 0·113956

$\frac{PG-PD}{2} = 0..57..17$ cos. 9·999939 tan. 8·221794

$\frac{DG}{2} = 2..9..22$ sec. 0·000307

Lat. $= 52..28..28$ sin. 9·899318

$\frac{DPG}{2} = 3..10..15$ ............ tan. 8·743494

$\frac{DPH-DPG}{2} = 0..4...8$ ............ tan. 7·079444

Hence, the angle G P H $= 3°..10'..15''-0°..4'..8'' = 3°..6'..7''$

Therefore, the required latitude is, 52..28..28 N, and longitude 3..6..7 W.

Lastly, assuming the semi diameter of the earth to be 3978 miles; the height of the balloon will be $\frac{3978}{\cos.\frac{1}{2}(D\,G)} - 3978 = \frac{3978}{\cdot 999296} - 3978 = 2\cdot826 =$ 2 miles 1454 yards.

In this last part of the calculation no allowance has been made for terrestrial refraction. If we assume it $\frac{1}{13}$th of the intercepted arc D H, it will make a difference of 806 yards in the height of the balloon.

I am, Mr. Editor, yours, &c.

George Scott,
Private Teacher of Mathematics.

21, New Church-street, Grove Road.

## ON THE COMPARATIVE DURABILITY OF ZINC.

Sir,—While a very numerous host of manufacturers are loudly extolling the superior qualities of zinc—lauding its *durability* to the skies, and adapting it to the construction of every variety of utensil, from a chimney to a watering-pot, I confess I am greatly surprised that one of these parties should come forward, to assert its perishability.

As it is not usual for tradesmen of any class "to cry stinking fish"—Mr. North is doubtless actuated by conscientious motives, in publishing at page 26, the results of his experience on the want of durability in the staple of his manufacture. At the same time, I must be permitted to remark, that the results of his experience are so widely at variance with the commonly-received opinion, as also with the observed facts of the comparative durability of zinc, even under the destructive influences of the most powerful galvanic arrangements, that I would beg to call the particular attention of your readers to the question raised by Mr. North, viz.: the rapid decay of zinc "under ground."

I am well aware, that in the universal adaptation of zinc, now so rife, many egregious blunders are continually committed; and I believe that a correct knowledge of its fitness or unfitness, under a peculiarity of circumstances, would be highly beneficial both to the public, and to manufacturers.

I am, Sir, yours respectfully,

WM. BADDELEY.

July 19, 1841.

## CHLORIDE OF ZINC.

Sir,—Permit me to ask, through your pages, where chloride of zinc is to be procured, as an article of commerce, or how to be made at reasonable cost and trouble? It is known here only at the druggists, as an escharotic, in some cases of cancer, &c., price about 2s. 6d. per ounce. This inquiry arises from having some experiments on foot, to compare the efficacy of several of the applications for preventing dry-rot, mildew, &c.—chloride of zinc being Sir William Burnett's.

AN OLD SUBSCRIBER.

Dublin, July 19, 1841

## ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

**** Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for the purpose.*

JOHN ROCK DAY, OF GREAT QUEEN-STREET, LINCOLNS-INN-FIELDS, SADLER'S IRONMONGER, *for certain improvements in the construction of collars for horses and other draught animals.*—Petty Bag Office, July 6, 1841.

The collar frame is made of two pieces of stout iron plate connected at the top by a pin joint; a segment-formed box is affixed to the back of one of the side frames, at its lower end, and to the lower end of the other, a curved bolt is attached by a joint pin. This bolt slides into the segment box, and has a tooth at its end, which, when the collar is closed, drops into an opening or slot in the under side of the box, and is held down therein by a spring bolt. The lower parts of the collar are thus held firmly together. Instead of the fore-wale of the collar being of stuffed leather, as usual, it is constructed of ribs of wood, and attached to the fore part of the metal frame by screws, being covered in front like the face of the collar, with japanned leather. The trace is attached to the collar by three arms, one of which is an extension from the metal frame, being slightly bent to the curve of the collar and enclosed by the padding within the same, an eye projecting through the side of the collar for receiving a screw pin; the other two are bracket arms, pinned to the metal frame, their outer end, like the former, being pierced to receive the screw pin. A tug, or eye piece on the end of the trace is brought between the ends of these arms and made fast by passing a screw pin through the three arms. To take off the collar, the spring bolt is withdrawn by its stud, when the curved bolt may be drawn back until its tooth catches against a stop at the end of the box, when the collar will be expanded, so as to be removed from the horse's neck without turning. If the collar is for double harness, two bent rods of an elliptic form descend from the lower part of the metal frame, their ends meeting when the collar is closed; from these rods the kidney-link is suspended, with the ring for the pole chain. An elliptic eye is formed in each end of the kidney-link, which, when the collar is closed, bears against shoulders on the rods, and assist in keeping their ends in contact. In order to expand the collar, the kidney-link is turned up, so that its elliptic eyes may correspond with the form of the rods, and allow of their being drawn apart, when the

sliding bolt is released. To adapt these collars for cart horses, instead of the spring bolt, a lever, turning on an axis fixed to the metal frame, is used. The nose of the lever presses against the back of the sliding bolt, and keeps its tooth in the slot, the other end of the lever being held by a pendant link. When the collar is to be expanded, the tail end of the lever is released from the link, and the sliding bolt set free, which is drawn back until its tooth comes against the stop at the end of the segment-box. To afford the necessary strength, two segment-boxes and sliding bolts are used to these collars.

The claim is, 1. To the mode of attaching and holding the opening parts of an expanding collar by means of a curved sliding bolt, acting at the throat part of the collar in a curved socket; the curved bolt being confined when the collar is closed by a spring-bolt, wedge-catch, or lever, made to act upon it at that time.

2. To the attaching of wooden ribs to the metal frames of the collars as fore-wales.

3. To the novel construction of arms, or brackets affixed to the metal framing, to which the tugs, or braces are to be attached.

George Childs, of Lower Thames-street, Merchant, *for improvements in the manufacture of bricks and tiles, part of which improvements are applicable to compressing peat and other materials.* Enrolment Office, July 6, 1841.

The clay is first to be prepared in a *washing-machine*, and the bricks made therefrom in a *brick machine*, neither of which are shown or described. The bricks are then pressed on a revolving wheel, after which they fall on to a web-strap beneath the wheel, whence they are removed by an attendant.

The patentee shows a wedged mould, and also a press for making artificial stone; likewise an expanded brick mould, and a press for pressing two bricks in separate moulds at the same time, from which the bricks are ejected by two pins acted upon by screws, which, being raised, lift the bricks out of the moulds.

This specification is wretchedly drawn; the descriptions are of the most vague and imperfect description. No improvements are set forth, nor is any claim made.

Henry Gunter, of Cullum-street, Fenchurch-street, Merchant, *for improvements in preserving animal and vegetable substances.* Enrolment Office, July 6, 1841.

The substances being first scalded, are put into cylindrical tin cases, which are nearly filled, and then hermetically closed. A number of these vessels are then immersed in a boiler: for animal substances, the boiling is continued for two hours and a half; for vegetables, from fifteen to five-and-twenty minutes. The vessels are then taken out of the boiler, and placed in a sand-bath, or other convenient mode of maintaining a temperature of 212°. In the upper part of each vessel a minute hole is made, through which the air and steam contained therein is expelled; while the steam is afterwards escaping freely, the hole is closed by soldering, and the operation is complete.

John Swindells, of Manchester, Manufacturing Chemist, *for certain improvements in the manufacture of artificial stone, cement, stucco, and other similar compositions.* Petty Bag Office, July 6, 1841.

This invention consists in the employment of the residual matters of various chemical processes for manufacturing the above-named substances.

In manufacturing the chromates and bichromates of potash and soda, and other chromic salts, a residuum remains, which consists of oxide of iron, silicate of alumine, lime, sulphate of lime, and undecomposed chromate of iron; this residuum is used for making artificial stone, in the following manner. If the lime does not amount to 50 per cent., and the silicate of alumine to 30 per cent., these substances are added till their proportions are respectively of those amounts. The materials being then intimately mixed, are calcined in an ordinary lime-kiln, reduced to a fine powder, and packed in casks for use.

For making Roman cement, the residuum produced in the manufacture of potash, soda, or British alkali, is employed. To a quantity of this residuum, containing 50 per cent. of lime, 30 per cent of the silicate of alumine is added, and also 20 per cent. of oxide of iron, (the latter resulting from the manufacture of sulphuric acid from the bi-sulphuret of iron,) or a similar quantity of oxide of manganese and iron, obtained from the residual salts of manganese, produced in the manufacture of chloride of lime, &c. These materials being thoroughly mixed, are calcined, powdered, and packed, as before.

The claim is, 1. To the use of the residuum produced in the manufacture of chromic salts for the manufacture of lithic, or stone cement, or artificial stone. 2. To the use of the residual matters produced in the manufacture of potash, soda, British alkali or soda-ash, commonly called vat-waste, and the residual oxide of iron produced in the manufacture of sulphuric acid from the bi-sulphurets of iron, commonly called pyrites or mundic. 3. To the use of the residual oxide of manganese, produced in the manufacture of chloride of lime or other chlorine salts, for the purpose of manufacturing stucco or Roman cement.

William Thompson, of Upper North-place, Gray's Inn-road, Brush-maker,

*for improvements in the construction and mounting of various kinds of brushes and brooms.* Enrolment Office, July 8, 1841.

These improvements relate to all kinds of brushes and brooms having their handles placed obliquely, and consists, firstly, in the means of adjusting the handle to any required position; and secondly, in a mode of lengthening the handle. To carry out the first improvement, the broom-handle is fixed obliquely in an intermediate piece of hard wood of a cylindrical form, the upper end of which is hemispherical, and the lower end plane. This intermediate piece is inserted perpendicularly in a recess in the broom-head, by a screw tang or pin, which passes through the head and is secured by a nut. Four or more holes are made in the bottom of the recess, into any two of which two studs projecting from the lower end of the intermediate piece are inserted, to keep it from turning in the recess after it has been once adjusted. By inserting these two studs in a different pair of holes, the handle of the broom may be made to assume a different position, the number of positions depending upon the number of holes that are provided. The lengthening of the broom-handle is effected by sliding over it a tube; at the top of the handle a small piston is packed, so as to generate friction enough to hold the tube at any required length to which it may be extended.

William Lacey, of Birmingham, Agent, *for certain combinations of vitrified and metallic substances, applicable to the manufacture of ornaments, and the decoration and improvement of articles of domestic utility, and of household furniture; also applicable to church-windows and ship-lights.* Enrolment Office, July 11, 1841.

These improvements, which are described under six different heads, are as follows:—

Firstly. A mode of ornamenting plate-glass, which may then be used for the decoration of picture and other frames, wainscoting, &c. &c.

Pieces of plate-glass, of the proper shape and size, have ornamental devices cut or etched on one side of them, which devices are cut and polished in the usual manner, while the original surface or table of the glass is roughened. The ornamented and plane surfaces are then silvered, and coated with a composition of copal varnish and white lead, or other pigment, to protect the silvering.

Secondly. A mode of attaching knife and fork handles, &c., when they are made of glass, enamel, or other vitrified substance. Their tubes or ferules of metal are inserted in the handles, in order to secure the tang of the knife, &c., more effectually; the tube or ferule being introduced into the handle while the glass is in a soft or semi-fluid state.

Thirdly. The construction of metallic window frames for churches. These frames are composed of a series of vertical parallel bars, grooved to receive the panes of glass; the vertical bars being continued upward, form the gothic arching at the top of the windows.

Fourthly. The construction of glass panes for glazing such windows. The top and bottom edges of the panes of glass are cut to an angle of 45°, so that the edges of the upper panes shall overlap those beneath them; the plates are then slid, one after another, into the grooves in the vertical bars, a moveable beading being provided, either at the top or bottom, for completing the series. The bevelled joints of the glass are luted with copal, or other similar transparent hard varnish; but the square edges are luted into the grooves with a mixture of copal varnish and white lead; or common putty may be used. The gothic compartments at the top of the window are to be glazed in the ordinary way.

Fifthly. The ornamenting of panes of window glass, by staining, etching, &c. Plates of glass being stained in the usual manner on one side, transparent colourless designs are produced upon it by etching, or cutting away a portion of the coloured surface. Or both surfaces of the glass are stained with the same, or with different colours, by removing a portion of which a variety of tints may be produced. Thus, if one side of the glass is stained yellow and the other blue, and figures are cut upon each, a play of white, blue, yellow, and green lights can be obtained.

Sixthly. The formation of ship-lights, which, instead of being of the usual colourless glass, are made of plates of glass of a suitable thickness, ornamented as above described, and mounted in the metallic frames before mentioned.

The claim is, 1. To the mode of ornamenting plate-glass by the combined processes of cutting, etching, roughing, and silvering. 2. To the insertion of metallic tubes or ferules in knife and fork handles, and in the handles of other cutlery, made of glass, enamel, or other vitrified substances, whilst the same are in a hard or soft state, or before or after the process of vitrification. 3. To the construction of the metallic frames of church windows grooved to receive the glass plates as described. 4. To the construction of glass panes for windows, whether plain or ornamented, with bevelled edges. 5. To the ornamenting by etching, cutting, or any other means, panes of glass for windows, stained or coloured on one or both sides. 6. To the formation of ship-lights made of glass ornamented in the manner described, of adequate thickness, and fixed in suitable metallic frames.

MATTHEW UZIELLI, OF KING WILLIAM-STREET, MERCHANT, *for improvements in impregnating and preserving wood and timber for various useful purposes.* (A communication.) Petty Bag Office, July 11, 1841.

The log of wood has a groove cut around it about 3 inches from its upper end, to which a bag of some water-proof material, open at both ends, is secured by a strap or band; the log is then placed upright in a trough, and the bag supported in an upright position, and some one of the following materials poured into it till the liquid stands a few inches higher than the top of the wood. The liquid then permeates the log, driving the sap out at its lower end; the process is not complete till the liquid, which passes through the wood, leaves it in an unaltered state.

For preserving and hardening the wood, the rough pyrolignite of iron in solution is employed; for preserving only, chloride of sodium. For giving flexibility and elasticity to the wood, for preventing its warping, and rendering it incombustible, the chlorides of calcium and magnesium, are used. To expedite the drying of the wood, a solution of sulphate of soda is employed.

By the same means, the wood may be dyed of any approved colour, by using any of the ordinary animal vegetable or mineral colours. Thus, blue may be obtained by using a solution of pyroliguite of iron and prussiate of potash; yellow, by acetate of lead and the chromate of potash; green, by a combination of the above; and so on.

To impart a fragrant smell to wood, alcoholic solutions of essential oils, and other odoriferous substances, may be employed.

The claim is, 1. To the improved method of impregnating and preserving wood and timber with chemical materials, for the purpose of preserving, improving, and beautifying its quality. 2. To the application of the peculiar materials, herein mentioned, for the purpose described.

We strongly doubt the power of the simple hydrostatic pressure of a "few inches of liquid" to perform the required task; the presence of a vacuum at the opposite end would doubtless achieve the permeation of the wood, and this *unpatented* process may perhaps be extensively adopted in preference to the foregoing.

WALTER HANCOCK, OF STRATFORD, ESSEX, ENGINEER, *for certain improved means of preventing accidents on railways.* Enrolment Office, July 14, 1841.

These improvements are divided into three branches. The first relates to the mode of working the breaks employed to arrest the progress of engines and carriages on railways; the second, to the switches for altering the line of traction; and the third, to the signals for indicating particular incidents in the working of railways.

The tender is furnished with a cylinder of four different diameters, and containing four pistons on one rod; the largest being about seven inches, and the smallest four inches in diameter. The spaces between the pistons are communicated with by four ports covered by a slide-valve, but are in free communication with each other, and with the water in the tank, by an eduction pipe. The boiler communicates with the valve-box by a small flexible tube, by which the pressure of its contents is communicated to the pistons when required. Two sliding rods are collared, together with the piston-rod, to a short cross head to which the train is attached; but the collars on the rods inside of the framing relieve the pistons from the strain occasioned by the draft. The other ends of the rods slide in guides, and are connected by levers to the tender's breaks, which it is advised should be so adjusted as to permit them to come in contact with the wheels, only when the engine and tender are running alone. Each carriage is fitted with breaks, suspended upon pins fixed in the framing in the usual way, and are connected to two levers on a shaft, on the middle of which two other levers are fixed, their extreme ends being received in slots provided for them in a rod. This rod is constructed of iron tubing, so as to afford the necessary stiffness and lightness; it is mounted on anti-friction rollers and steadying brasses, and extends beyond the ends of the carriage, to just one-half the distance between the preceding and succeeding carriages, terminating at each end in a buffer-head. There are two springs for returning the rod to its central position, as regards the length of the carriage, after it has acted on the breaks. When it is required to stop the train, the operation is as follows:—the slide-valve is to be drawn off the first port, which allows the steam pressure in the boiler to act against the small piston, which effects a reduction of the distance between the first carriage and the tender, and the aft breaks of all the carriages in the train are applied to the wheels simultaneously, with a force collectively equal to the area of the piston. This force can be increased by opening the other ports in succession. Backing of the carriage is provided for, by admitting the pressure from the boiler through the fifth port only, while the others are closed; there is also a provision for applying the breaks by hand when requisite.

The second head of these improvements, relating to switches, consists in substituting a self-acting apparatus for the usual switch-

tender. A common switch is connected by a rod with a vertical lever, by which it is opened or closed in the usual manner. On the centre of this rod there is a stud, on which is loosely affixed one of the arms of a double bell-crank lever, moving on a centre pin affixed to the sleeper. To the cross arms of this lever the ends of two pair of rods are jointed, while their opposite ends are connected to the double crank levers. The ends of the long arms of these levers are fitted with anti-friction rollers, which slide upon plates provided for them. To give effect to this apparatus, four slants are suspended from the framing of the tender, at a suitable distance below the axles, whereby the switch is adjusted exactly as required, on whichever side of the line it may happen to open, or in whatever direction the engine may be going. The mode of operation is as follows:—if a switch has been negligently left open, the consequence, according to the present system of working, would be, that the engine, &c., instead of continuing its direct course, would cross over to the other line, to the imminent risk of life and property; but by the adoption of the present apparatus, the slant would force the lever into its proper position, and send the switch home to the rails before the engine reached the point of divergence.

The third, and last branch of these improvements consists in a new mode of signals, which may be managed by hand, or without hand, and which will serve at once to signalize events and incidents, and to denote the exact time of their occurrence. Four hollow glass globes are placed at equal distances around a central reservoir common to, and communicating with, all four; the whole turns freely upon a spindle which passes through the central reservoir, and is firmly fixed to a post placed in a convenient position by the side of a railway: all these vessels (except the uppermost one for the time) are filled with red, or any other bright coloured transparent fluid. Each of the globes communicates with the reservoir by two tubes, one entering at its upper part, the other at the bottom; the latter being fitted with a stop-cock, to retard the return of the liquid to the reservoir as much as may be desired. On the apparatus being caused to make one-quarter of a revolution, a full globe will be raised to the top, from which the liquid will begin to run back to the reservoir, at the adjusted rate, until it is empty; and so on, continually, as often as the apparatus is made to make a quarter-revolution, one or other of the vessels will be raised in a full state to the top. This apparatus is covered with a screen, having an aperture, through which the elevated globe only is visible, with a strong light behind it. By means of a suitable arrangement of levers and ratchets, the glass globes make one-fourth of a revolution on the depression of a lever, either by hand or by the passing of a train. The rate at which the coloured fluid will descend from the uppermost globe will, of course, depend upon the adjustment of the stop-cock; the driver of an approaching train may, therefore, by this means, judge of the time which has elapsed since the preceding train passed the signal-post, and regulate his speed accordingly, being at all times guided by the height of the coloured fluid in the globe.

*Intending Patentees, or Patentees of unspecified inventions, may have every needful information and assistance on moderate terms by application to the Office of this Journal, where also may be consulted the only Complete Registry extant of Patents from the earliest period (A.D. 1617,) to the present time.*

NOTES AND NOTICES.

*Preservation of Boots and Shoes.*—Never allow boots or shoes to dry for any length of time in the dirt. Housewifes sometimes lay fuller's earth on boards to extract the grease therefrom; dry dirt acts in the same way upon leather, drawing out all the animal matters which constitute the virtue of the leather. The care should be by continual blacking, and the occasional application of some unctuous matter to maintain the natural state of the leather. When the original proportion of animal fats, &c. is greatly diminished, the leather becomes harsh, cracks, and perishes rapidly. The *Macerone composition*, (i. e. 2 parts of tallow and 1 part of rosin melted together) is the best that can be applied, both to soles and upper leathers; to the former its application should be plentiful and frequent. It is a well-established fact, although not sufficiently known, that the difference between the durability of *carefully* and *carelessly* managed boots and shoes is as one to three. B.

*Rotation of the Sun.*—Professor Gruithuisen has ascertained that the siderial rotation is made in 25 days, 14 hours, 54 minutes, and 5 seconds; and that its synodic rotation is completed in 27 days, 13 hours, 17 minutes, and 19 seconds.

*The Population of Birmingham,* according to the late census, is upwards of 138,000, being an increase of nearly 25 per cent. within the last ten years.

*London University.*—Mr. Vignoles has been appointed professor of civil engineering in this college, and will give his first course of lectures during the ensuing winter.

*Advice to Shavers.*—Always warm your razor previous to using, by immersion in warm water, and after using, wipe it clean and strop it well before putting it by. You may strop it or not before using, just as you please, but upon no account omit this precaution afterwards. If the razor is a good one, under this mode of treatment it will last an indefinite time. A relative of the writer of this notice has now in daily use a razor which has already lasted one long life, and threatens to wear out its present possessor, without the edge having ever been put on any other sharpening instrument than the strop. B.

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## BURSILL'S PATENT BAROMETERS.

Fig. 1.

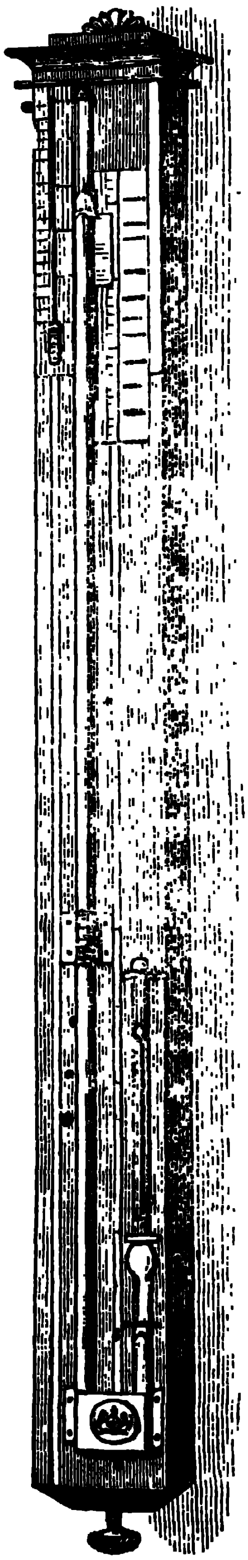
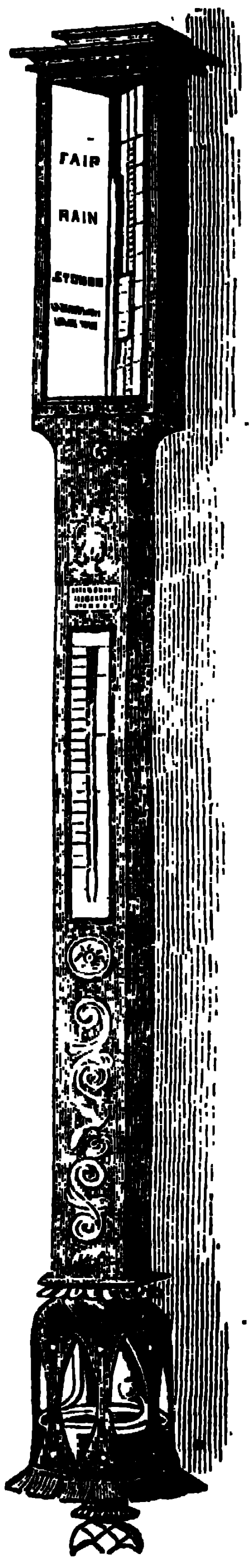


Fig. 2.

Fig. 3.



## BURSILL'S PATENT BAROMETERS.

The Barometer, whether considered with reference to its character as a meteorological instrument—or in its numerous and varied applications to the purposes of practical science—is an instrument of such great value, that any improvement tending to simplify its use—to increase its accuracy—or to extend its powers, must prove a fertile source of gratification to every philosophic mind.

We have great pleasure, therefore, in directing the attention of our readers this week to the valuable improvements recently patented by our esteemed correspondent Mr. Bursill; which ensure to a very remarkable extent, the qualities which we have just enumerated.

A Standard Barometer to indicate the direct pressure of the atmosphere all over the globe, *totally independent of change of temperature*, has long been a desideratum. The Mercury employed in the construction of Barometers is liable to expand or contract about the $\frac{1}{100}$ part of its volume, by a change of temperature amounting to only 90° Fahrenheit;—so that, even during the ordinary changes of the atmosphere, and still more particularly in the ascent or descent of mountains in tropical climates, a question immediately arises as to *how much of the rise or fall of the Barometer should be attributed to increased heat or cold*; and, although this question may in fact be solved by reference to the Thermometer at the time of observation, it is only to be done by the aid of a complicated formula—not easily understood except by scientific persons—nor easily retained by them, since the length of the Barometrical column is perpetually varying from other causes besides temperature, and the difficulty of making an exact computation is thereby greatly increased.

In addition to the defect already mentioned, it is an equally incontrovertible fact, that Barometers generally are, as at present constructed, open to another source of inaccuracy, namely that the height of the Mercurial column is frequently more or less than is apparent upon the graduated scale, owing to a change of level of the Mercury within the cistern, which change of level always accompanies any rise or fall of the Barometer.

It is true, that the latter evil can be lessened, in exact proportion as the size of the cistern is augmented; but such enlargement of the cistern, without altogether removing the evil, renders the Barometer expensive, and far less portable; while a variety of different-sized cisterns gives rise to great discrepancy in the observations.

In "Bursill's Patent Standard-Syphon," "Patent Syphon-Marine," and "Patent Compensating-Cistern" Barometers — these difficulties have been overcome, by arrangements equally novel and efficient, and so simple, that the manner of using the Barometer is at once intelligible to persons of ordinary capacity; while, to those who have devoted much attention to this interesting subject, great satisfaction will be derived, by an investigation of the principles upon which these valuable machines are constructed.

Bursill's Patent Standard Syphon Barometer, represented by Fig. 1 on our front page, has its tube so proportioned, that any expansion or contraction of the mercury, from change of temperature, is always thrown into the long arm, the mercurial level in the short arm remaining totally unaffected except by change of *pressure*. Thus, by placing the instrument in hot water, a considerable rise of the mercury in the long arm is very soon perceptible, but no alteration of level can be detected in the short arm, even by the aid of a magnifying-glass.

Fig. 2 is a section, in which it will be seen that two brass rods are employed, and attached to the lower end of each of these rods is a finely-toothed rack. These racks are worked by a small toothed wheel placed between them, and to these motion is given by a screw working in a fixed socket, the arrangement being such, that when one of the rods is worked upwards, the other is made to descend in exactly the same proportion; one of these rods is graduated in inches, and serves to form the scale; to the other is attached a small arrow, carrying a vernier, and carefully adjusted to the level of the mercury in the barometrical column, at 32° Fah.

*To use the instrument,* all that is necessary is, to adjust the arrow-point or

zero (o) on the graduated scale to the level of the mercury in the short arm; by aid of the screw at bottom: the upper arrow affixed to the rod on the opposite side, and to which arrow is also attached a vernier of the usual description, will then point out the true height of the barometrical column, corrected for temperature; for should any mercury be seen above the arrow, it arises from expansion, or should any void space be seen below, it is owing to contraction.

The true pressure of the atmosphere is thus obtained almost in an instant, without arithmetical calculation or reference to tabular forms; for in this barometer there is no necessity to make allowance for the expansion of the brass scale, since, by the employment of two rods, the one exactly serves to correct the other. The usual correction for capillary attraction is also unnecessary, for in the Syphon Barometer, when both ends of the tube are of the same diameter, (as in this instance,) the action is exerted equally in each, and the effects of depression become entirely lost.

Bursill's Patent Compensating Cistern Barometer, (Fig. 3,) has all the advantages of the best barometers hitherto constructed, excepting only the Standard Syphon Barometer just described, since it is not corrected for the expansion or contraction of the mercury, &c., &c., and is therefore to be read off from the level of the mercury, (and the necessary corrections made afterwards, for nice purposes,) in the usual way.

The great advantage is, that the mercury, by a simple yet self-acting contrivance, is always preserved upon a level within the cistern, notwithstanding any rise or fall that may take place in the barometrical column.

In ordinary barometers, the barometrical scale is graduated in inches from the level of the mercury in the cistern, and the first change that takes place in the atmospheric pressure, after the instrument is made, by inducing a change in this level, throws it all wrong. Many attempts have been made to overcome this difficulty, but hitherto they have all of them been attended with some inconvenience.

In the Patent Compensating Cistern Barometer, the object sought is fully accomplished by simply bending the lower end of the barometer tube to a right angle, and afterwards twisting it into a spiral form—the cohesion of the mercury being found to be so great, as to effectually exclude the ingress of any atmospheric air. A horizontal movement of the mercury is thus produced, instead of a vertical one as heretofore, and the lightness and portability of the instrument are extreme, since the quantity of mercury made use of is very small, and the barometer may even be inverted without the danger of spilling it, although the end of the tabular cistern is quite open to the air.

These instruments having a greater range than those ordinarily made use of, and their construction admitting of the most elegant designs, render them beautifully adapted for house barometers; they are however particularly eligible for marine purposes, since they require no adjustment, the use of a gauge-point being not so readily applicable at sea as on shore, except in a dead calm. The Standard Syphon Barometer, also, is applicable to marine purposes, means having been taken to prevent oscillation, which in no measure affects its accuracy. Mountain Barometers are also manufactured upon the same principle.

These instruments were exhibited, and attracted considerable attention, at a late meeting of the Meteorological Society, who considered them most valuable inventions, displaying extreme ingenuity in construction, and possessing improvements long wanted in this instrument. A committee was appointed to examine minutely into the merits of these barometers, who have since reported of them in terms of the highest commendation.

## RATIONAL PHILOSOPHY—LETTER IV.
## POWER.

*The only power, force, or means of action throughout the whole of Physical Nature consists in the Impulsive Pressure of the Medium of Space.*

Sir,—Matter being essentially inert, a planet is inert; it is but a mass of inert elementary atoms, and, as such, requires a constantly impelling cause to keep it in motion.

Matter being incapable of acting of itself, cannot suffer either essential or mechanical change by its like; the substance of its elementary atoms is in all respects as at the beginning, and must for ever remain incapable of alteration by time or service. Hence, the only change which bodies, and the elementary atoms of bodies can suffer, is of a local nature or change of place.

Motion being the only effect produceable on matter—in which there is no variety, but as respects velocity and direction—in the pressure of the medium of space we have the only analogous cause conceivable for both atomic and planetary motion. The latter requires cause as general as planetary space, and to effect the former in bodies, it is only necessary that atomic matter should be spherical, in order that the common medium of pressure and motion should have free access through the interstices of all bodies, great and small, solid and fluid.

The solid state results from elementary atoms being externally compressed together; and decomposition is effected when the pressure within a body is greater than on its surface. Menstrua dissolve nothing; they only present recipient interstices for the atoms of the substance to be dissolved. The medium of space within a body, like water in a submerged sponge, being continuous with the like medium in space generally, the pressure of the latter—the general pressure—is, as it were, conveyed to the interior of every body, and may be likened to a kind of back spring pressing centrifugally against every atom in a body, and ready to expand the body, or to force out its atoms according as the body is surrounded by a medium of fire or some aqueous medium.

It is not the natural fact that "acids" act on bodies: bodies are composed of atoms, the substance of which can suffer no act but that of impulsive pressure: neither have the atoms of a menstruum any essentially acting properties whatever. Matter is inert, it can do nothing. Acidity is but a sensation, promoted in the mind by sense-excitement of the brain, and by means which have nothing whatever in common with the sensation. Nothing of the whole of light, colour, heat, cold, flavour, sound and odour, or of their likeness, excited in the mind by the agency of the senses, belongs to matter. All sense-excited knowledge informs us positively of what matter *does not* possess, and all "chemical properties" are but our own sensations, but which are gratuitously and falsely imputed to matter and bodies. The world is mechanical; its principles, as its construction and performances evince, are wholly mechanical; and the essence of the atoms of matter is cause in no instance, nor is it concerned in any terrestrial production whatever.

The general pressure is not to be valued by mere atmospheric pressure; nor can it be denied, that in nature there exists means of pressure equal to the collapsing of atoms, so as to force a body which shall have the tenacity of steel. What but pressure elevates islands from beneath the ocean's bed—which produces the tornado which shakes and rends the globe—causes earthquakes—and makes whole tracks of land as moving bogs, to change their localities? The great waterspout evinces more than atmospheric pressure by its superior elevation. To pressure within the bar, alone, can be attributed the expansion of steel, of which fire is but a promoting means; also the sudden collapse of atoms when aerolites are formed. What is the tenacity of the densest bodies to the forcible expansion of a drop of confined water while being congealed? Pressure only can account for the production of these phenomena. With it all our falsely assumed causes bear no comparison: altogether they cannot account for the force of steam, or of exploded gunpowder. Besides attraction, repulsion, central forces and gravitation, modern science has nothing of *cause;* these together cannot account for the motion of a stone through the air after it has ceased to be impelled by the hand; and the whole are evidently false causes, from being inconsistent with the inertia of matter.

All selfaction being inconsistant with inertia, at the same time all inert matter being in a state of local change, impelling and impelled, to the known universal pressure alone can we refer for universal cause of action: no other is analogous to the common effect, motion; and no universal agent for

such purpose can be referred to but a medium-filling space, in which the planets may be said to float, by which they are under constant physical impulse, and by which all manner of bodies are penetrated.

Pressure is nothing assumed, and its universality is admitted: it accounts consistently for every phenomenon from the formation of a plant to the collapsing of the atoms of a grain of sand; from the eruption of a volcano to the ripple on a pond; from the concussion of thunder clouds, to the pulsation of the heart. Were the general pressure suspended, all motion, all life, all growth would be instantly at an end,—Nature at a stand-still, and the heavenly bodies themselves lose their consistency.

Neither is it a question how the known, the universal pressure commenced, and is maintained: its universality of action is undeniable, and beside it, throughout the entire of physical nature, no auxiliary power, form, property or quality, is required. It may, however, be conceived, that the Allwise putting together of the parts of the system, originated that state of pressure so necessary for the production of motion, and that the resulting planetary motions are tributary to the continuance of the pressure on which these motions depend. To which may be added, that, in all probability, the whole order of the system is dependent on the shape and size of the atoms of the different elements of matter: in which latter respect only, there is any difference in the initial materials of the universe of planetary bodies.

Matter, therefore bodies, being naturally inert, there can be no motion without its equal of impulse. Hence, planetary motion, projectile motion, and the motion of a grain of dust in the air, is, each, equally the effect of physical impulse being continued, however invisibly, as long as that motion continues: otherwise it is self motion after impulse has ceased; a circumstance as impossible as the voluntary ascent of a stone from the ground into the air.

Nothing short of a medium of pressure or motion filling space, can keep all things to which motion is not natural, in a state of endless motion. This medium of space, is the first and final cause, next to God, of all planetary, all bodily, all atomic transfer: it is the *primum mobile* of nature, and by it only is any thing whatever put into a state of force. It collapses atoms, contracts bodies, expands, explodes and disperses in every instance; and, by acting partially on a body, it is the universal cause of the common effect, motion. Beside this universal cause, why should we look for any other? A common physical power to act forcibly on atomic substance in every direction, is all the system requires to perpetuate its phenomena.

> The CAUSE, which made of atoms, spheres,
> Gives form to all terrestrial things,
> The same it is which moulds our tears,
> And on the heart's blood draws the strings.
>
> PRESSURE it is which rolls the earth,
> And all the planets by it turn,
> It keeps to Man supplied his breath,
> It wings the wind, it moves the worm.

T. H. PASLEY.

Dublin, Bachelor's Walk.

*Errata.*—Letter III, page 407, column 2, line 1, for "the collection," read "any collection;" line 14, "for volume," read "colour;" line 20, for, "as though," read, "as thought;" page 408, column 1, line 3, for, "that the adoption," read, "but the adoption."

## URWIN'S SYSTEM OF WORKING STEAM-ENGINES.

Sir,—Mr. Urwin's letter, at page 197 of your last volume, is any thing but a reply to my statements and remarks on his new system of working steam, described in the 912th number of your excellent periodical.

I offered no opinion in my last communication, though I took occasion to do so some time since, in Number 914; and questioned the propriety of changing the "power" of engines, by varying the "volume" of steam supplied to the cylinder, instead of by "pressure." For the introduction of such matter, also the "mode" of cutting off steam, the slides, their lap, &c., dwelt upon by Mr. Urwin, is quite irrelevant, and does not in the slightest degree bear upon the question at issue, which is simply this, "Does the old mode of expanding wholly within the cylinder, or the new system of working proposed by Mr. Urwin, produce the greatest mechanical effect with a given quantity of steam?"

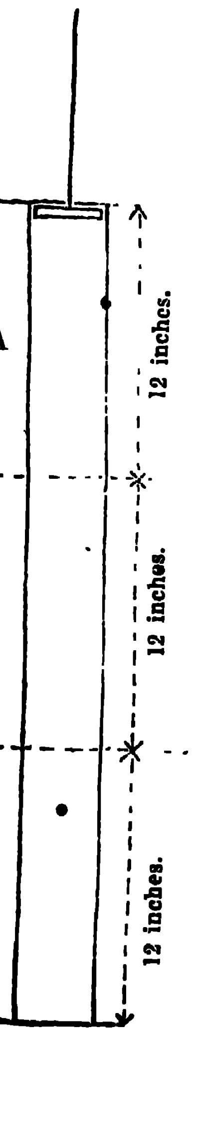
It is unnecessary to notice, perhaps, the assertion of Mr. Urwin, "that I have steam of twenty pounds left with which I do not know what to do;" but I will just request him to look again a little more

attentively at the fourth paragraph, from which I suppose he has drawn the inference, and the following also, and I doubt not he will then comprehend the reason the supposition was not carried beyond two expansions; the object, in fact, being, as he will perceive, merely to obtain the means of comparison, and not to point out the extent to which the expansion might be carried with profit.

Mr. Urwin reminds me that "there is steam at all times in the expansive chamber." I was aware of the fact, and that it accumulated in pressure, too, to an extent; but conceived at the moment, that as a greater quantity of the original steam would remain in the cylinder, and be discharged into the condenser, the value of such increase would probably be neutralized. However, on reflection it became apparent that it was wrong to neglect the point; and by subsequent calculation I make the pressure uniform at about 24 pounds per inch, instead of 16, which I before assigned for commencing the operation of returning the piston, of which the new system shall receive the full benefit; as I have neither wish nor motive for depriving it of one iota of its dues—the sole object being to honestly arrive at facts, and not to depreciate the merits of the invention.

I must, therefore, in justice observe, that steam of 40 pounds' pressure, worked in Mr. Urwin's engine, will be reduced not to less than 10 pounds, as stated in my last communication, but probably to something less than 14, at the termination of each complete stroke, in consequence of the accumulation which takes place in the expansive chamber, and which shows it has undergone in "effect" three expansions, instead of three and a half, on which my calculations were founded in my last paper.

The following diagram is intended to represent a cylinder of three feet in length, divided by dotted lines into three equal sections, with a piston of one inch area. On the sides of the figure, and opposite the respective sections, the value of the two modes are placed in contrast. Section A is supposed to represent the cylinder of

| *Old System.* | | | *New System.* |
|---|---|---|---|
| Steam Pressure. 40 x 12=480.. | A |  | Steam Pressure. 40 x 12=480 |
| Mean. 30 x 12=360.. | B | | Nil. |
| Mean. 17 x 12=204.. | C | | Mean. 19 x 12=228 |
| 1044 | | | 708 |

Mr. Urwin's engine, through which the piston is driven by steam from the boiler of 40 pounds' pressure; and the sum opposite, on the right, is the amount of the effective force multiplied by the length of the section. Section B is intended to represent the expansive chamber, containing the supply of steam of 24 pounds' pressure before noted, and of the assumed size of one and a half times that of the cylinder for driving the piston through section C; and section C is designed to represent the return stroke of the piston; and the sum on the right, as before, is the amount of the mean effective force, multiplied by the length of that section; and at foot appears the aggregate.

By the common, or old mode of applying the principle, the volume of steam and the number of expansions being the same, the steam would be admitted from the boiler until the piston moved through one-third of the cylinder, or to the extremity of section A; and from thence the stroke would be effected through sections B and C by the power of expansion alone. Hence the utmost power which the steam is capable of exerting within that "limit" is communicated to the piston, the value of which, for each section, will be found opposite on the left; and at foot, as before, appears the aggregate.

Thus the mechanical effect produced by the old mode amounts to 1044 pounds, and by the new system only 708 pounds, showing a deficiency of nearly 33 per cent, or one-third; therefore it is manifest, that after conceding every advantage, the new system does not bear out the high character claimed for it.

I will put the matter, however, in another shape, by way of confirmation. Suppose that, instead of driving the piston with the full force of the steam from the boiler one way, and returning it by expansion the other, Mr. Urwin were to throw aside his expansive chamber, and supply the cylinder with steam of 40 pounds' pressure "each way," cutting it off at one-third, and expanding the remainder of the stroke, a mean effective force would be produced of 29 pounds. Thus 29 × 12 = 348 × 2 = 696 pounds are obtained in a complete revolution of the crank, which is within a mere trifle of the amount produced by the new system, though two-thirds the steam only is expended, and exactly proportionate to the difference in the foregoing calculations.

Mr. Urwin's engine may be considered to derive its power chiefly from, or to be worked by, the two ends of the column of steam contained in the cylinder; namely, by the original pressure of section A, and the most reduced of section C; consequently the value of the expansion from A to C is wasted beyond the benefit afforded to C, by the accumulation for which I have given credit; to which has to be added the waste occasioned by discharging into the condenser the 24 pound pressure steam left in the cylinder, producing together the difference exhibited in the value of the two systems. But notwithstanding this, Mr. Urwin says that "whatever advantage 'Alpha' can claim for working expansively belongs to my improved system; while in addition"—mark this—"the *steam is worked over again* in the manner set forth in my specification."

So it appears Mr. Urwin has succeeded in persuading himself to believe the fallacy, that he is actually "working the steam over again," while, in reality, he is only working expansively, under great disadvantages. The deception, however, arises from his severing the expanding column, and making the return stroke with one portion of it.

I will now conclude by observing, that the only way of obtaining the "utmost power" from steam of any given pressure is simply to fill the cylinder to such an extent only as will leave sufficient room to run it down by expansion to the lowest useful point above vacuum; when the whole force it is capable of exerting will be transferred to the piston. And shape the operation however you may, I repeat, that no greater benefit can possibly be obtained from this exceeding simple, very beautiful, and invaluable principle, than this mode will yield.

But a difficulty in carrying the principle to a great extent in some cases arises from the unequal velocity occasioned by the great variation in the power during the stroke. This, as I took occasion to remark in the paper before alluded to, inserted in the 911th Number, can be remedied to a great extent by employing two cylinders; and as they can be worked with one slide, the chief drawback to such an arrangement is occasioned by a small addition to the friction, from a little increase of piston surface, &c., which, however, is scarcely worth mentioning, especially in comparison to the advantage gained.

I have been for many years a warm advocate for the expansive principle, from a thorough conviction of the immeasurable advantages it will confer generally, and on "steam navigation" in particular. And when, Mr. Editor, those who are more immediately connected with, and interested in, our commercial and naval marine, shall rouse from slumbering over the present system, and justly appreciate and apply this vastly important principle,—which they will do at no distant day, because they must adopt it, notwithstanding the degree of indifference at present manifested—then will a new era commence—then will the capabilities of this omnipotent agent be doubled in reality, and our splendid steamers navigate the ocean with one half the fuel now consumed; and which will be hailed hereafter as the greatest boon steam navigation has received (or, perhaps, is capable of receiving) since its introduction. Not so much, however, on account of the saving in the cost of the fuel itself, as that will form but an item (unless it be at very distant stations from the supply) among the advantages which will result from the adoption.

I remain, Sir,

Yours most respectfully,

ALPHA.

Limehouse, March 10, 1841.

*Erratum.*—In the last paragraph but one in my paper inserted in the 914th number, read "25 per cent." instead of "35."

## SAFETY AXLE GUARDS.

Fig. .

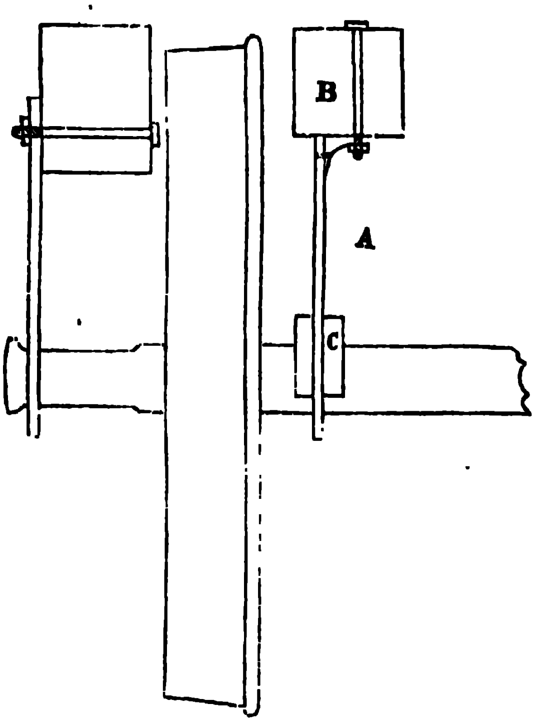
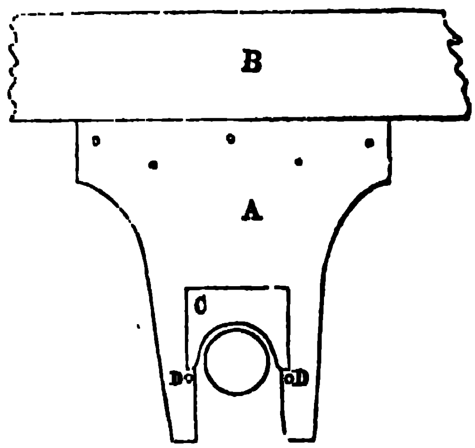



Fig. 2.




Sir,—The late accident upon the South Western Railway, occasioned by the failure of the axle of the tender, induces me to send you a plan of a Safety Axle Guard, which has been for some time in use upon the tenders working on the Leicester and Swamington Railway. It is very effective and simple; the original expense is comparatively small, and its wear nothing, as it never comes into use unless the axle end breaks off. It has prevented several accidents, the tender axles having occasionally failed, but the Safety Axle Guards always bring them home safe. On one occasion the tender axle end broke off without the engine driver being at all aware of it, and it was discovered only when the tender was examined after coming safe home.

I see no reason against the use of this safety axle for all kinds of carriages upon railways, more particularly those used for coal or heavy goods, whose axles are more liable to failure; many serious accidents would be thus avoided. They

were introduced by Mr. Nicholson, the superintendant of locomotives on the London and Southampton Railway.

I am, Sir, yours, &c.

W. CHAPMAN.

Leicester, July 14, 1841.

*Description.*

The same letters refer to the same parts in both figures. A is the Safety Axle Guard, which is screwed to the under side of the longitudinal tender B, which runs inside the tender wheels. C is a brass bearing, which fits the axle inside the wheel, as shown, figure 1. The axle guard is cut out so as to leave about ¼ an inch of space between the brass and the axle; when the tender is loaded, the brass is held up to the axle guard by the two pins D D, through the axle guard, so that while the axle and springs are good, there is no bearing, but if the axle end break off, the tender then falls upon the bearing C. The spring and common bearing are omitted in the sketch to prevent confusion.

THAMES STEAMERS.

Sir,—"Nauticus" has given us, at page 469 of your last volume, a flattering account of our Thames steamers, including some recent additions. As he seems to be intimately acquainted with these boats, will he oblige your readers by appending to the information already given, an account of the *steam pressure* under which each is really worked?

Several of those which have hitherto been designated low-pressure engines —and asserted to be working with steam not exceeding 8 lbs. on the inch—are now working under a very different system, said in some cases to be using ten times that pressure.

In pushing the *Brunswick* a fortnight ago, the boilers were ruptured: can "Nauticus" tell us under what pressure they gave way?

It would seem as if our engineers had taken a leaf out of Mr. Napier's book, in order to "*eclipse*" every rival. Whatever may be their practice, the present question is one of vast importance to all who are interested in steam navigation, and of *vital* interest to the steam travelling public.

Expecting a candid answer, I am, Sir, yours respectfully,

RUFUS.

Whitechapel, July 15, 1841.

THAMES v. CLYDE-BUILT STEAMERS.

Sir,—In the June part of your Magazine, I see a letter signed "Nauticus," giving a splendid account of the unparalleled speed of the Thames steamers, which, *as low pressure ones*, are "the fastest in the world." Now it is quite possible they may go down stream at the speed he states, but I am afraid, they will not come up in such good time. But granting all he says, I should like to ask him a question. How comes it—(the London vessels being such perfections of beauty and speed)—I say how comes it, that London Steam Boat Companies come all the way to Glasgow to purchase boats, especially as the Londoners have such a contempt for country-made engines? Almost all our half worn-out boats go to London, and other places, and are counted very good ones then. It is very praiseworthy to be attached to our native place; but what are we to think of the capacities of the man, who, in this liberal age, hugs any and every little improvement that may come out to the world, forsooth, because it was invented by a citizen of his much-loved town? Certainly not much. I will not praise our Clyde vessels for unparalleled speed —I believe 13 or 15 miles per hour can be attained by them—but I shall state facts. The Commercial Steam Boat Company bought one of our Glasgow-made boats, viz.: the *Grand Turk*. They have a good many vessels, I dare say, an average of the good and bad; but I believe they allow that this boat has given them more satisfaction than any. By satisfaction we must either believe that it goes quicker, requires less repair, or consumes less fuel, all of which are great recommendations. The aforesaid Company, yet once again, have bought two more of our boats, one having run about four years, the other two; neither of them are first-class vessels. Now I should be glad if "Nauticus" would just notice the speed of these vessels when they get to London, (I believe they will be there this week;) let him for once divest himself of prejudice, and tell us the real speed they obtain, and if they don't attain the speed of the Thames vessels, the reason why?

By insertion of this, you will oblige yours, &c. A. M.

P.S. The names of the vessels are the *Robert Burns*, made by Murdoch,

Aitken, and Co. Glasgow. The *Sir Wm. Wallace*, by Smith and Rodgers. Glasgow. The *Grand Turk* was made by M. A. and Co., also. A. M.

Glasgow, July 12, 1841.

### WORKING STEAM EXPANSIVELY.

Sir,—The diffusion of a correct knowledge of principles, and the exposure of their erroneous application, I apprehend are objects especially regarded in the *Mechanics' Magazine.* At present, the prospect of the increasing use of steam worked expansively in a portion of the cylinder after the communication with the boiler has been closed, renders it desirable that correct methods of ascertaining the mean pressure in the cylinder of the steam so expanded, should be generally employed by the parties engaged either in the supply or management of steam-engines. In adverting to the subjoined extract from Mr. B. Boyman's observations on Pilbrow's Condensing Cylinder Engine, recently published, I am enabled to adduce an instance of a curious, but I believe not uncommon error, in the assumption of a variable basis for expansion calculations, dependent on the vacuum in the condenser.

It is stated, that,

"Giving the advantage to rotative engines of being worked expansively, to the greatest extent that steam will permit, the comparison will stand thus:—

*Engines of the present construction so worked.*

| | |
|---|---|
| Full steam pressure in cylinder, per square inch ............ | 3 lbs. |
| Extreme condenser vacuum .... | 13·5 |
| | 16·5 |

"The steam being cut off at half-stroke would reduce it to 8·25 lbs. (below atmospheric pressure) before it entered the condenser, which is as low, or nearly as low, as it can be expanded in the present constructed engines: this will give a mean pressure, during the stroke, of about 13·75 lbs. per square inch.

*Pilbrow's Condensing Cylinder Engine.*

| | |
|---|---|
| Full steam pressure as before, in cylinder........ ........ | 3 lbs. |
| But as this condenser is swept out by every reversal of the piston, a better extreme vacuum than the above will be maintained, of about 1 lb. .. | 14·5 |
| | 17·5 |

This will give a mean pressure of 14·56lbs."

Nature, however, works by constant laws, and it is well known that the *total steam or gas pressure* is the true basis on which Marriotte's law, that the pressures are inversely as the volumes when the temperatures are constant, is founded.

Hence, in both cases, $3 + 14{\cdot}75 = 17{\cdot}75$ lbs. ought to be taken as the pressure from which the pressures at other points should be deduced: thus, $\frac{17{\cdot}75}{2} = 8{,}875$ lbs. would be the pressure at the end of the strokes in both engines.

The mean pressure would be ·8465 of a full stroke pressure of 17·75 lbs., and consequently about 15 lbs. mean pressure in the cylinder, per square inch: if calculated by the more common method, the greater number of points taken, the closer would become the approximation to the pressure here given. This 15 lbs. mean pressure is the true basis from which the deductions due to each engine should be made to obtain the effective pressure, available for the purposes to which they may be applied.

But these deductions are a practical question, to which it is unnecessary to advert; and if Pilbrow's engine finds as warm supporters in deeds as in words, practice will in a short time afford a far more valuable criterion of its merits, than *à priori* opinions on this subject.

I remain your obedient servant,

S.

July 15, 1841.

### BURNING SMOKE.

Sir,—I have lately perused with great pleasure the valuable publication of Charles W. Williams, Esq., on combustion; and as there is something said of it in your No. 928, allow me to state that, for at least twenty years past, I have caused the fire in my parlour grate, (in which bituminous coal is used,) to be kindled at the top, by which means, instead of dull smoke, for an hour or so, going up the chimney to choke the flue, I have a cheerful blaze from the commencement.

But it must be noticed that, to effect this desirable object, you must only use the round coal, which will admit a cur-

rent of air to pass up through it to inflame the gas according as it is produced.

Some good and simple contrivance to burn the small coal, or *slack*, in the same manner, is very desirable. Some persons mix it with tenacious clay, or other binding substance, and form it into balls with the hands, but this is troublesome, and it makes an ashy fire: others wet it, and lay on a thick coat over the fire, making a hole through it with a poker; but in this case a great proportion of the bituminous part of the coal is driven up the chimney in the shape of smoke. Could this be obviated by the aid of a few conical air-tubes, made of fire-proof earthenware, suitably placed *in* the fire?

Your friend and subscriber,

EBENEZER SHACKLETON.

Moone Mills, Ballitore,
July 17, 1841.

P.S.—You say, "The more is the pity," that the public care little *who* is the inventor, so that the invention be useful. At all events, inventors care that their names shall be known to that ungrateful fellow, the public; and so I give my name in full.

### THE CORNISH ENGINES.

Sir,—The surplus duty performed by the Cornish single action pumping engine, over and above the apparent steam pressure on the piston, in comparison with the water load in the pit—is a subject that has been discussed and commented on frequently in your Magazine—and by very able writers; nevertheless there continues to exist great diversity of opinion on this interesting topic. We may therefore be justified in concluding, that the excess of duty performed is not attributable to any pet theory, nor does it arise from *one* specific cause, but is brought about by a combination of circumstances happily applied to this magnificent machine. These circumstantial causes may fairly be described as follows:—*Firstly*, the judicious clothing which the cylinder, boilers, and steam pipes receive, and the admirable nursing of the motive power throughout all parts of the engine; the saving of fuel occasioned by these precautionary measures is great indeed. *Secondly*, the "percussive" action alleged by Mr. Josiah Parkes, as taking place instantly on opening the communication between the cylinder and boiler to admit steam at a *high* pressure; this unquestionably is *one* of the great acting causes, and will partly account for the seeming discrepancy between the power applied, and the duty performed, by these engines, as the piston receives such a sledge hammer blow from the "percussive" force of the steam—that it does not recover itself until nearly the whole of the stroke is performed, when, the expansibility of the steam finishes that which the percussion commenced; and as the steam attenuates itself at the close of the stroke to a force acting so feebly as to be scarcely appreciable—it will account for the admirable condensation which afterwards takes place. *Thirdly*, the almost perfect cylinder exhaustion occasioned by the manner in which the steam is used. In many of these engines the steam valve scarcely opens half an inch, and not above a second of time is occupied in so doing,—consequently, although the blow the piston receives is tremendous, still the *quantity* of steam admitted is not too great to prevent the almost perfect vacuum which follows. The cylinder being longer than those usually applied to double-acting engines of equal diameters, the internal capacity is of course greater, consequently more ample space is afforded the steam to expand; the result of such attenuation is an easy and almost instantaneous condensation. A long stroke in the cylinder enables the engineer to obtain a corresponding length in the plunger poles and working barrels, but admirably modified by the adoption of the unequal beam, which eases the pit work; thus, with a fewer number of strokes as much water can be raised, as with a short cylinder engine making a greater number of strokes in the same period; whilst an immense advantage is gained—in ample time being afforded the engine for that perfect cylinder evacuation, which is thus shown to be *another* of the great acting causes of triumphant success in the single action expansive engine.

Although these engines are not the invention of Cornwall, the remarkable duty they are now performing in the west of England, will warrant me in

asserting that the Cornish engineers stand unrivalled in the unwatering of deep mines.

I remain, Sir,

Your obedient servant,

LIONEL BROUGH.

Neath, Glamorganshire, July, 1841.

ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

*** *Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for the purpose.*

MELCHER GARNER TODD, OF THE ISLAND OF ST. LUCIA, *for a certain improved form of apparatus for the distillation and rectification of spirits.* Enrolment Office, July 14, 1841.

This apparatus consists of an improved still, in which two separate distillations and rectifications are carried on at one time by the same fire. The wash is contained in a large reservoir placed above the still, one part of it being portioned off to form a rectifier; the wash is supplied to the still by a pipe and cock. The neck of the still passes through the wash reservoir, and is connected by a pipe with the rectifier; the rectifier is furnished with a neck, through which the vapour contained within passes into a worm. There is a man-hole in the top of the wash reservoir surmounted by a neck, which communicates with a second rectifier also within the reservoir, which rectifier, like the former, has a neck connected with a worm.

A fire being kindled beneath the still its contents become heated, the vapour passes off through the neck of the still, and part of it being condensed by the wash in the reservoir, is condensed and runs back again, heating by its condensation the wash in the reservoir. The uncondensed vapour proceeds through the pipe into the rectifier, where another aqueous portion is condensed, and a spirit of considerable purity obtained in the worm. The wash receives a further accession of heat from this last condensation, and a very pure spirit rises from it, which passes through the neck and pipe into the second rectifier, and from thence into the worm connected with the same.

The furnace is placed beneath the still, and is provided with lateral openings and dampers, by opening of which a portion of the fire is allowed to act upon the bottom of the wash reservoir which projects beyond the top of the still.

The claim is, 1. To the arrangement and disposition of the still and wash reservoir, by which the naked fire may be applied to those vessels in their combined state, or to the still alone.

2. To the peculiar combination of vessels described, by which two distinct distillations and rectifications are conducted with one fire, and their separate products obtained.

JOHN LOACH, OF BIRMINGHAM, BRASS FOUNDER, *for certain improvements in castors applicable to cabinet furniture and other purposes.* Enrolment Office, July 14, 1841.

Between the socket and horns of the castor, a horizontal anti-friction wheel is placed turning on the pin of the castor; the upper side of this wheel works in contact with a flange on the pin of the castor, which is sunk into a recess in the bottom of the socket. The under side of the wheel works on the top of the horns, supporting them by means of a semicircular projection which bears against its periphery. A similar anti-friction wheel is also applied to plate castors, its upper side working against the plate by which they are fastened to the piece of furniture; and its under side on the horns as before.

The claim is to the introduction of a horizontal anti-friction wheel between the bottom of the socket and the horns, which wheel bears the weight upon the castor, and supports the horns, by the projection on the latter bearing against its periphery.

JAMES FURNIVAL, OF WARRINGTON, LANCASTER, TANNER, *for an expeditious mode of unhairing, mastering, and tanning various descriptions of hides and skins.* Enrolment Office, July 14, 1841.

This invention consists in the use of the following apparatus for operating in the ways above enumerated on all foreign or English ox, cow, horse or other hides, kips, calf, hog and seal skins.

The tanning apparatus consists simply of a revolving tub or cylinder having a number of longitudinal beams inside, so placed as to occasion an uneven motion in the tanning liquor. The skins being introduced through a door in the side of the cylinder, with the tanning liquor, the door is closed and secured by bolts or wedges. Five or six of these tubs may be used in succession, the liquor contained in them being of different strengths. For unhairing, a cylinder of frame work, or the close cylinder with a grating substituted for the door, is placed in the pit, so that two-thirds of it are immersed in the liquor. The skins being put into the cylinder, it is caused to make ten revolutions per minute. For mastering, the same apparatus is employed, but a slower motion is employed; two or three revolutions per minute only, being best adapted for this process.

The claim is to the right of the apparatus herein described for thoroughly tanning the above-mentioned skins.

CHARLES CAMERON, LATE CAPTAIN IN

THE 81ST REGT., FORMERLY OF MOUNT VERNON, AND NOW OF DARNAWAY-STREET, EDINBURGH, *for certain improvements in engines to be actuated by steam or other elastic fluids.* Enrolment Office, July 14, 1841.

In these engines one or more cylinders may be employed, which are attached to a hollow horizontal axis, capable of revolving in plummer blocks firmly bolted to the engine frame. The piston rods work through stuffing-boxes at each end of the cylinders, and are attached to a moveable frame provided with trucks, which traverse a circular path forming part of the framing of the engine and placed eccentric to the circle described by the cylinders. Steam being admitted through the hollow axis to the cylinders, forces the pistons outward, which by means of the moveable frames, trucks, and eccentric guides, causes the cylinders and their axis to assume a curvilinear or rotary motion, which motion may be applied to drive any kind of machinery in the usual manner.

The claim is to the method herein described of converting the rectilinear motion of a piston in a cylinder into a curvilinear or rotary motion.

WILLIAM KENWORTHY OF BLACKBURN LANCASHIRE, SPINNER, AND JAMES BULLOCK, OF THE SAME PLACE, OVERLOOKER, *for certain improvements in machinery or apparatus for weaving.* Petty Bag Office, July 14, 1841.

These improvements are two-fold. The first consists in substituting for the ordinary temples, a small roller coated with fine sand, emery or other rough substance. The cloth passes between this roller and a semicircular trough or casing placed beneath it, on its way to the cloth beam, and is held by the roller at a uniform width during the beating up of the weft by the reed.

The second improvement consists of an arrangement for stopping the loom whenever the weft thread breaks or fails; in the end of the reed, three or more wires are inserted, and when the stay moves the reed forward to beat up the weft, the forks of an elbow-forked lever enter between these wires, and being pressed against by the weft are forced back a little, thereby raising the hooked end of the lever, which is the heaviest. But when the weft thread fails, the forks project through the wires, and the hooked end of the lever falls by its own weight, and is caught by another hook, formed in the segmental head-piece of a vibrating lever, and drawn back. By this movement a horizontal lever is made to strike the knocking-off rod, which shifts the strap from the fast to the loose pulley, and lifts the click of the taking-up apparatus out of the teeth of its ratchet wheel.

PIERRE ARMAND LE COMTE DE FONTAINEMOREAU, OF SKINNER'S-PLACE, SISE-LANE, *for improved machinery for carding and spinning wools and hairs, which he titles "filo-finisher."* (A communication.) Enrolment Office, July 14, 1841.

This machine contains all the parts necessary for the operations of carding and spinning: the wools and hairs are put into it in the state of patted slivers, and are delivered by it in the state of spun wool, twist, yarn, or thread, thus performing in one machine the two separate processes of the carding-engine and the mule spinning-jenny.

After passing through the carding part of the machine, the wool reaches the steel spinning spindles, which are placed horizontally, and have each an eye in their ends, corresponding with the interior of a tube through which the thread passes to be twisted and wound on the bobbin. This tube is supported by a brass or tin cylinder, fixed upon the spindle by a circular metal plate, and has upon its end a pulley, by which the spindle is made to revolve. Upon the spindle there is a metal conducting tube, which supports the bobbin, to which motion is given by a pulley. The bobbins traverse upon the conductor tubes in the direction of their axes, so that each part of the surface of the bobbin may be presented to the end of the tube from which the thread runs off. The bobbins containing the slivers of patted wool being placed in a frame at the carding end of the machine, the wool is drawn from them by the ordinary feeders, passing over a wooden lattice-work or grating, which is so divided, as to distribute the wool necessary for each spindle in an equal and uniform manner, over the whole surface of the great drum. This drum, conjointly with the workers and retakers, cards the wool supplied by the feeders, which is then detached by the flier; the drum then presents the wool to the combers, which, turning, lift the wool from the drum, and convert it into small ribbons. These ribbons being introduced into the spindles, are stretched by the reciprocating motion of the bobbins, and twisted by the spindles, the thread being fastened or wound upon the drawing-bobbin.

The claim is to the spindle, the tube conductor or bobbin-bearer, and the winding up bobbin, whereby the substance to be spun is drawn from the comber, and twisted and wound up uniformly about the centre of the radius of rotation, on a bobbin, which keeps the yarn or thread stretched in a uniform state of tension. Also the combination and arrangement of parts herein described, whereby the operations or processes of carding and spinning may be performed by the same machinery.

EDWARD FOARD, OF QUEEN'S-HEAD-LANE, ISLINGTON, MACHINIST, *for an improved method, or improved methods of supplying fuel*

*to the fire-places or grates of steam-boilers, brewers' coppers, and other furnaces, as also to the fire-places employed in domestic purposes, and generally to supplying fuel to furnaces or fire-places in such a manner as to consume the smoke generally produced in such furnaces or fire-places.* Petty Beg Office, July 16, 1841.

The fuel is supplied to furnaces from beneath in the following manner:—immediately under the centre of the fire-grate, and opening into it there is a quadrangular chamber provided with a piston which moves up or down therein by racks and pinions; in front of this chamber there is a door through which coals may be thrown. A fire being made in the furnace, the piston, on which the coals have been placed, is raised at intervals until it reaches the top of the chamber and the coals are all consumed; a sliding plate is then brought over the mouth of the chamber, between the burning coals and the piston, which is lowered to the bottom of the chamber. The door of the chamber is opened and a fresh supply of coals thrown in: after which the door is closed, the sliding plate withdrawn, and the piston gradually raised as before. Instead of the sliding plate, a temporary plate may be placed on the piston and the supply of coals thrown on to it: when the piston reaches the top of the chamber, the ends of four spring levers project under and support the plate, while the piston is lowered for a fresh charge of coals, another temporary plate being first placed upon it, when the chamber is filled, the uppermost plate is then withdrawn through a small door in the upper part of the chamber.

The claim is, 1. To the application of a door to the chamber or coking oven, to facilitate the supplying of fuel thereto.

2. To the mode of supporting the fuel by means of the plate or surface, when the plate or surface is used in combination with a piston and chamber, or oven, as herein described.

3. To the mode of applying a temporary plate working within the chamber or coking oven as described.

Samuel Hall, of Basford, Nottinghamshire, Civil Engineer, *for improvements in the combustion of fuel and smoke.* Enrolment Office, July 14, 1841.

These improvements are six in number. The first consists in a mode of supplying furnaces with fuel, by which the entrance of cold air at the same time is prevented. A hopper is placed in an inclined position in front of the furnace, from which the fuel descends over an inclined plate to the front of the fire-bars, from whence it is taken back into the furnace by an apparatus next to be described. The inclined plate is hinged at the bottom, so as to be lowered to the level of the fire-bars, when the cinders or fire are to be removed.

The second improvement consists in a method of retarding the combustion, and an apparatus for raking or clearing the fire-bars. The openings in the fire-bars for the admission of air are furnished with sliders, which are closed whenever it is desired to retard the combustion of the fuel. Beneath the fire-grate a framing runs upon wheels, from which a number of long teeth project between the fire-bars; when it is desired to rake the fire, these teeth rise up between the bars, and are made to travel towards the back of the furnace, which gradually moves the coal backward, and clears the openings between the fire bars. At the back of the furnace the teeth are lowered from between the bars, and the apparatus returned to the front of the furnace.

The third improvement consists in the use of a pipe perforated with small holes, extending across the fire-place, through which water may be occasionally sprinkled on the fuel in front of the furnace.

The fourth improvement consists in supplying heated air to steam-engine and other fire-places, by passing it through tubes or passages within the boiler and smoke-box, and also through short tubes around the fire-box. In order that the steam generated by this increased heat may not be lost, it is led through a pipe into a small chamber within the water in the tender, from which it passes through a number of tubes into a second chamber, thereby imparting its heat to the water previous to its introduction to the boiler. As the draught in the fire-places of locomotive engines when at rest is very small, the patentee proposes to increase it, by directing small jets of steam up the chimney; in the same way that the waste steam effects this object when the engine is in motion.

The fifth improvement consists in the use of a bent metal plate in the upper part of the smoke-box, leaving spaces between the sides and top; this plate is perforated with a number of small holes, the aggregate area of which is more than the area of the chimney, so as to allow a free passage for all the gaseous matters, but at the same time to prevent the escape of any large piece of fuel, &c., into the chimney.

The sixth improvement consists in placing the pipes used for heating air previous to its admission into the fire-places, mentioned in a former specification, not only in the chimney or chamber leading thereto, as therein mentioned, but in any part of the flues of the boiler through which the flame or heated gases circulate, in the passage from the furnace to such chimney or chamber.

JOSEPH PRYOR, OF WENDRON, CORNWALL, BUILDER, *for an improved threshing machine.* Enrolment Office, July 28, 1841.

This machine consists of a strong wooden frame standing on four legs, or otherwise supported in a substantial manner. An axle lying across the frame, and working in suitable bearings, has keyed on to it at one end a heavy fly-wheel, at the other a large spur-wheel; outside of these wheels, at the two extremities of the axle, there are two winch-handles, by which the machine is worked by hand, or it may be driven by any other convenient mover. A second axis, lying parallel with the former and similarly mounted, carries a pinion which gears into the spur-wheel before mentioned, and also a wooden drum, from the periphery of which project eight, or any other convenient number of angular iron beaters. This drum has a moveable case or covering over its upper circumference, with an opening in front, through which the grain is supplied to the machine from a feeding-table. Below the feeding-table there is a sliding rack, having a concave wooden surface corresponding to the outer circumference of the drum and beaters, upon which surface a series of angular iron plates are fixed; this rack slides backward and forward upon a bearer stepped into the frame of the machine, its distance from the drum being regulated by an adjusting screw, which works through a fixed nut in the cross rail. A rapid motion being communicated to the drum, and the corn fed in, it is carried down under the drum, and the seeds separated from the straw by the action of the beaters and the rack

The claim is to the general arrangement and combination of parts, by which a new and improved mode of operating is introduced.

LIST OF DESIGNS REGISTERED BETWEEN JUNE 28TH AND JULY 28TH.

| Date of Registration. 1841. | Number on the Register. | Registered Proprietors' Names. | Subject of Design. | Time for which protection is granted. |
|---|---|---|---|---|
| June 28 | 731,' | J. and G. H. Humphries | Carpet | 1 year. |
| July 2 | 736 | J. and J. Walker | Velvet | 1 |
| " | 737 | James Dixon and Sons | Teapot-handle | 3 |
| " | 738 | G. Wilkinson | Scissor Spring | 3 |
| 5 | 739 | J. Yates | Stove | 3 |
| 6 | 740,1 | J. and G. H. Humphries | Carpet | 1 |
| " | 742 | J. T. Christy | Coal-plate | 3 |
| 9 | 743 | George Ratcliffe | Fender | 3 |
| " | 744 | Henderson and Co. | Carpet | 1 |
| " | 745,7 | Joseph Newcomb, Son, and Jones | Ditto | 1 |
| 15 | 748 | S. Beckhans | Pen | 3 |
| 16 | 749 | Mrs. J. Larbalestier | Sleeve | 3 |
| " | 750 | W. Thornthwaite | Writing-case | 1 |
| 19 | 751 | J. Lamb and J. Best | Hinge | 3 |
| 21 | 752 | Woodward, Gandell, and Co. | Carpet | 1 |
| " | 753 | T. W. Atler and Co. | Truss | 1 |
| 22 | 754 | Davis, Brothers | Telescope | 3 |
| " | 755 | Newcomb, Son, and Jones | Carpet | 1 |
| " | 756 | W. F. Mills | Hair-brush and Comb | 1 |
| 28 | 757 | W. Wilson | Trowser-strap | 3 |

LIST OF ENGLISH PATENTS GRANTED BETWEEN THE 28TH OF JUNE AND THE 28TH OF JULY, 1841.

John Chater, of the Town of Nottingham, machine-maker, and Richard Gray, of the same place, lace manufacturer, for improvements in machinery for the purpose of making lace and other fabrics, traversed, looped, or woven. June 26; six months.

Willoughby Methley and Thomas Charles Methley, of Frith-street, Soho, ironmongers, for improvements in machinery for raising, lowering, and moving bodies or weights. (Being a communication.) June 26; six months.

Moses Poole, of Lincoln's-inn, Gent., for improvements in producing and applying heat. (Being a communication.) July 26; six months.

William Losh, of Little Benton, Northumberland, Esq., for improvements in the manufacture of railway wheels. June 26; six months.

Nathaniel Benjamin, of Camberwell, Gent., for improvements in the manufacture of type. (Being a communication.) June 28; six months.

William Knight, of Durham-street, Strand, Gent., for an indicator for registering the number of passengers using an omnibus or other passenger vehicles. June 28; six months.

Christopher Nickels, of York-road, Lambeth, Gent., for improvements in the manufacture of matresses, cushions, paddings or stuffings; and in carpets, rugs, or other napped fabrics. June 28; six months.

William Thomas Berger, of Upper Homerton, Gent., for improvements in the manufacture of starch. June 28; six months.

Thomas Marchell, of Soho-square, surgeon, for improvements in raising and conveying water and other fluids. June 28; six months.

George Henry Phipps, of Deptford, engineer, for improvements in the construction of wheels for railway and other carriages. July 2; six months.

Thomas Hagen, of Kensington, brewer, for an improved bagatelle board. July 7; six months.

George Onions, of High-street, Shoreditch, engineer, for improved wheels and rails for railroad purposes. July 7; six months.

Robert Mallet, of Dublin, engineer, for certain improvements in protecting cast and wrought iron and steel, and other metals, from corrosion and oxidation; and in preventing the fouling of iron

ships, or ships sheathed with iron, or other ships or iron buoys, in fresh or sea water. July 7; six months.

William Edward Newton, of Chancery-lane, civil engineer, for certain improvements in the manufacture of fuel. (Being a Communication.) July 7; six months.

Thomas Fuller, of Bath, coachmaker, for certain improvements in retarding the progress of carriages under certain circumstances. July 7; for six months.

Andrew M'Nab, of Paisley, North Britain, engineer, for an improvement or improvements in the making or construction of meters or apparatus for measuring water or other fluids. July 7; six months.

Charles Wheatstone, of Conduit-street, Gent., for improvements in producing, regulating, and applying electric currents. July 7; six months.

John Steward, of Wolverhampton, Esq., for certain improvements in the construction of piano fortes. July 7; six months.

Thomas Young, of Queen-street, London, merchant, for improvements in lamps. July 9; six months.

Charles Payne, of South Lambeth, chemist, for improvements in preserving vegetable matters where metallic and earthy solutions are employed. July 9; six months.

William Henry Phillips, of Manchester-street, Manchester-square, civil engineer; and David Hichinbotham, of the same place, Gent., for certain improvements in the construction of chimneys, flues, and air tubes, with the stoves, and other apparatus connected therewith, for the purpose of preventing the escape of smoke into apartments, and for warming and ventilating buildings. July 13; six months.

Benjamin Beale, of East Greenwich, engineer, for certain improvements in engines, to be worked by steam, water, gas, or vapours. July 13; six months.

Moses Poole, of Lincoln's-inn, Gent., for improvements of steam baths, and other baths. (Being a communication.) July 13; six months.

Miles Berry, of Chancery-lane, civil engineer, for improvements in the construction of locks, latches, or such kind of fastenings for doors and gates, and other purposes to which they may be applicable. (Being a communication.) July 14; six months.

Thomas Peckston, of Arundel-street, Strand, Bachelor of Arts, and Philip Le Capelain, of the same place, coppersmith, for certain improvements in meters for measuring gas, and other aeriform fluids. July 15; six months.

Andrew Smith, of Belper, Derby, engineer, for certain improvements in the arrangement and construction of engines, to be worked by the force of steam, or other fluids; which improved engines are also applicable to the raising of water and other liquids. July 21; six months.

John M'Bride, manager of the Nursery Spinning Mills, Hutchisontown, Glasgow, for certain improvements in the machinery and apparatus for dressing and weaving cotton, silk, flax, wool, and other fibrous substances. July 21; four months.

John White Welch, of Austin-Friars, merchant, for an improved reverberatory furnace to be used in the smelting of copper ore, or other ores which are or may be smelted in reverberatory furnaces. July 21; six months.

Frederick Theodore Philippi, of Belfield-hall, calico-printer, for certain improvements in the production of sal ammoniac, and in the purification of gas for illuminations. (Being a communication.) July 21; six months.

William Ward Andrews, of Wolverhampton, ironmonger, for an improved coffee-pot. July 21; six months.

William Newton, of Chancery-lane, civil engineer, for certain improvements in machinery for making pins and pin-nails. (Being a communication.) July 28; six months.

Anthony Bernhard Von Rathen, of Kingston-upon-Hull, engineer, for improvements in high-pressure and other steam-boilers, combined with a new mode or principle of supplying them with water. July 28; six months.

Anthony Bernhard Von Rathen, of Kingston-upon-Hull, engineer, for a new method or methods (called by the inventor, "The United Stationary and Locomotive System) of propelling locomotive carriages on railroads and common roads, and vessels on rivers and canals, by the application of a power produced or obtained by means of machinery and apparatus unconnected with the carriages and vessels to be propelled. July 28; six months.

## LIST OF SCOTCH PATENTS GRANTED BETWEEN THE 22ND JUNE AND THE 22ND JULY, 1841.

William Ryder, of Bolton, Lancaster, roller and spindle maker, for certain improved apparatus for forging, drawing, moulding or forming shafts, spindles, rollers, bolts, and various other like articles. Sealed, June 23, 1841.

John McBride, manager of the Nursery Spinning and Weaving Mills, Hutchesontown, Glasgow, for certain improvements in the machinery and apparatus for dressing and weaving of cotton, silk, flax, wool, and other fibrous substances. Sealed, June 25, 1841.

Andrew Kurtz, of Liverpool, Lancaster, manufacturing chemist, for certain improvements in the construction of furnaces. Sealed, June 25, 1841.

Thomas Young, of Queen-street, London, merchant, for improvements in lamps. Sealed, June 28, 1841.

William Newton, 66, Chancery Lane, Middlesex, civil engineer, for certain improvements in machinery or apparatus for picking and cleaning cotton and wool. Sealed, June 29, 1841. (Being a communication from abroad.)

Morris West Ruthven, of Rotherham, York, engineer, for a new mode of increasing the power of certain media when acted upon by rotary fans or other similar apparatus. Sealed, June 30, 1841.

Anthony Bernhard Von Rathen, of the Borough of Kingston-upon-Hull, engineer, for certain improvements in fire-grates, and in parts connected therewith, for furnaces for heating fluids. Sealed, July 8, 1841.

John Swindells, of Manchester, Lancaster, manufacturing chemist, for certain improvements in the manufacture of artificial stone, cement, stucco, and other similar compositions. Sealed, July 9, 1841.

John Rangeley, of Camberwell, gentleman, for improvements in the construction of railways, and in the means of applying power to propelling carriages and machinery. Sealed, July 15, 1841.

### NOTES AND NOTICES.

*Mr. Oxley's Plan for a Steam Vessel.*—Sir,—I have just been looking over the original drawings of the plan of the steam vessel I invented in 1807, and of which the description appears in No. 937 of your interesting journal of this day, and by comparing the two together, I find that in the original, the figure, No. 1, in your Magazine, is in mine called a side view, in which some parts are omitted to prevent confusion in the delineation, which parts appear in the other drawing; and I also find figure 2, in page 67, is called a bird's-eye-view, which is intended by me to show the manner of stopping the vessel, or reversing the motion thereof.

Have the goodness to give this note a place in your next number (No. 938) which will render the description perfectly understood by all your readers. I remain, Mr. Editor, most respectfully, your very obedient servant,

London, July 24, 1841. THOMAS OXLEY.

LONDON: Edited, Printed, and Published by J. C. Robertson, at the Mechanics' Magazine Office, No. 166, Fleet-street.—Sold by W. and A. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; and W. C. Campbell and Co., Hamburgh.

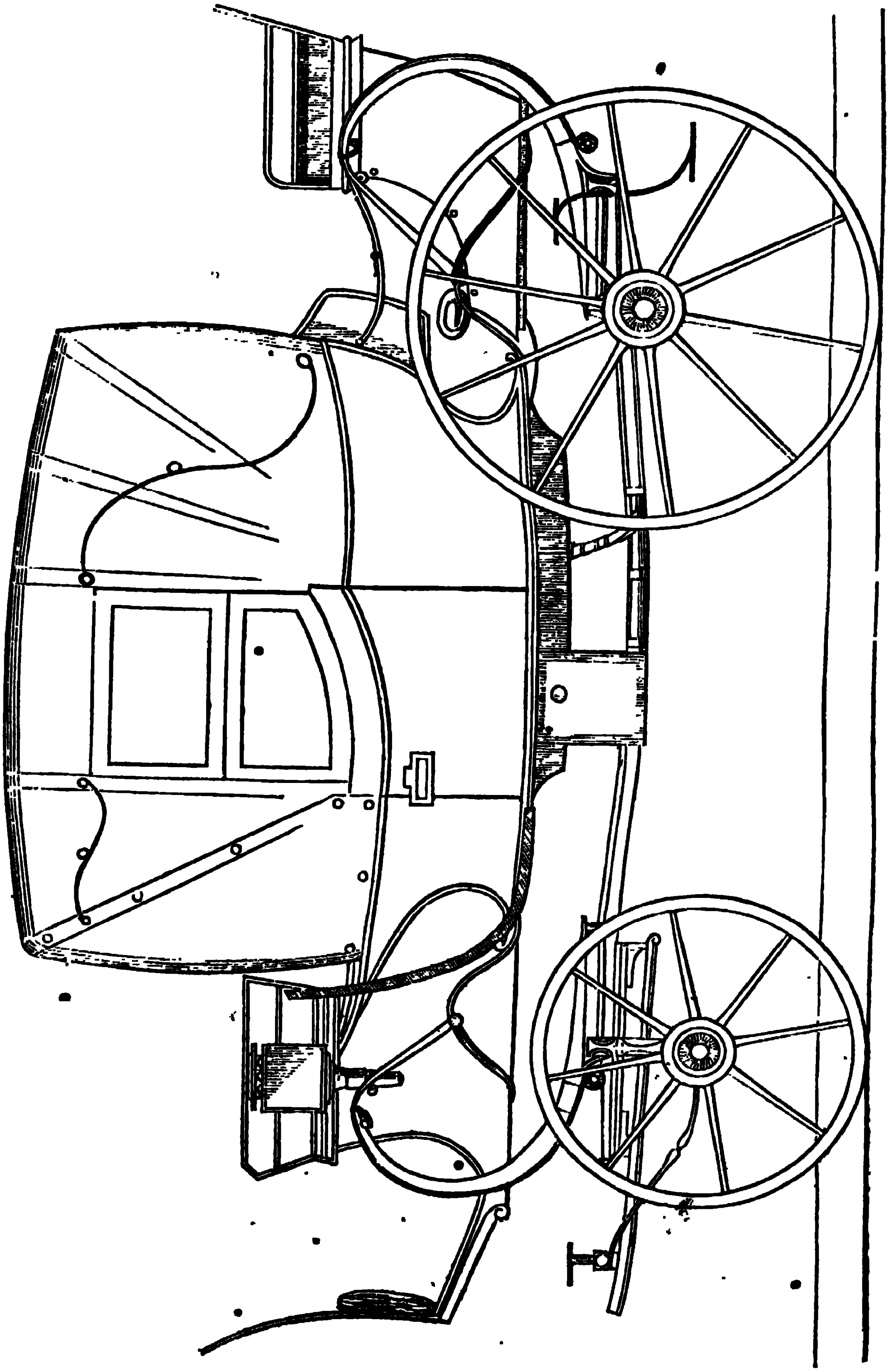
# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 939.] SATURDAY, AUGUST 7, 1841. [Price 3d.

Edited, Printed and Published by J. C. Robertson, No. 166, Fleet-street.


## HOLLOWAY'S PATENT HEAD FOR OPEN CARRIAGES.



## HOLLOWAY'S PATENT HEAD FOR OPEN CARRIAGES.

In a recent number we inserted a notice, copied from a provincial paper, of a valuable improvement in Britzska-heads, patented by Mr. N. I. Holloway, and the patentee has enabled us this week to lay before our readers a full description of the peculiarities of his very ingenious contrivance. The subject is one of considerable interest, relating, as it does, to the improvement of a most important branch of our domestic manufactures. English pleasure carriages have long maintained an unrivalled celebrity throughout the world, and the improvements we are about to describe will add another feature to the numerous comforts and conveniences for which they are so pre-eminently distinguished.

The advantages of the patent head are—that when down, the entire head lies on the elbows of the hind seat like a half head (from which, without the closest scrutiny it cannot be distinguished,) and yet can be raised almost instantly, and form a closed carriage for four persons—as shown on our front page.

It may be extended to enclose only two persons, when in addition to the shutter in front, it has side glasses, allowing a comfortable entrance and plenty of room inside, in which form it is shown on the opposite page.*

This head is applicable to all the various styles of light open vehicles now so much in use.

It is composed of five round-cornered bows; the third, fourth, and fifth are secured by hinges and goosenecks to the top of the standing pillars; the second has a dove-tailed catch and bolt on its extremities, to secure it when up, to the top of the front elbow rails, the ends of which stand over the door joints to receive the glasses; the first bow is hinged to the second, and a German shutter arranged in it.

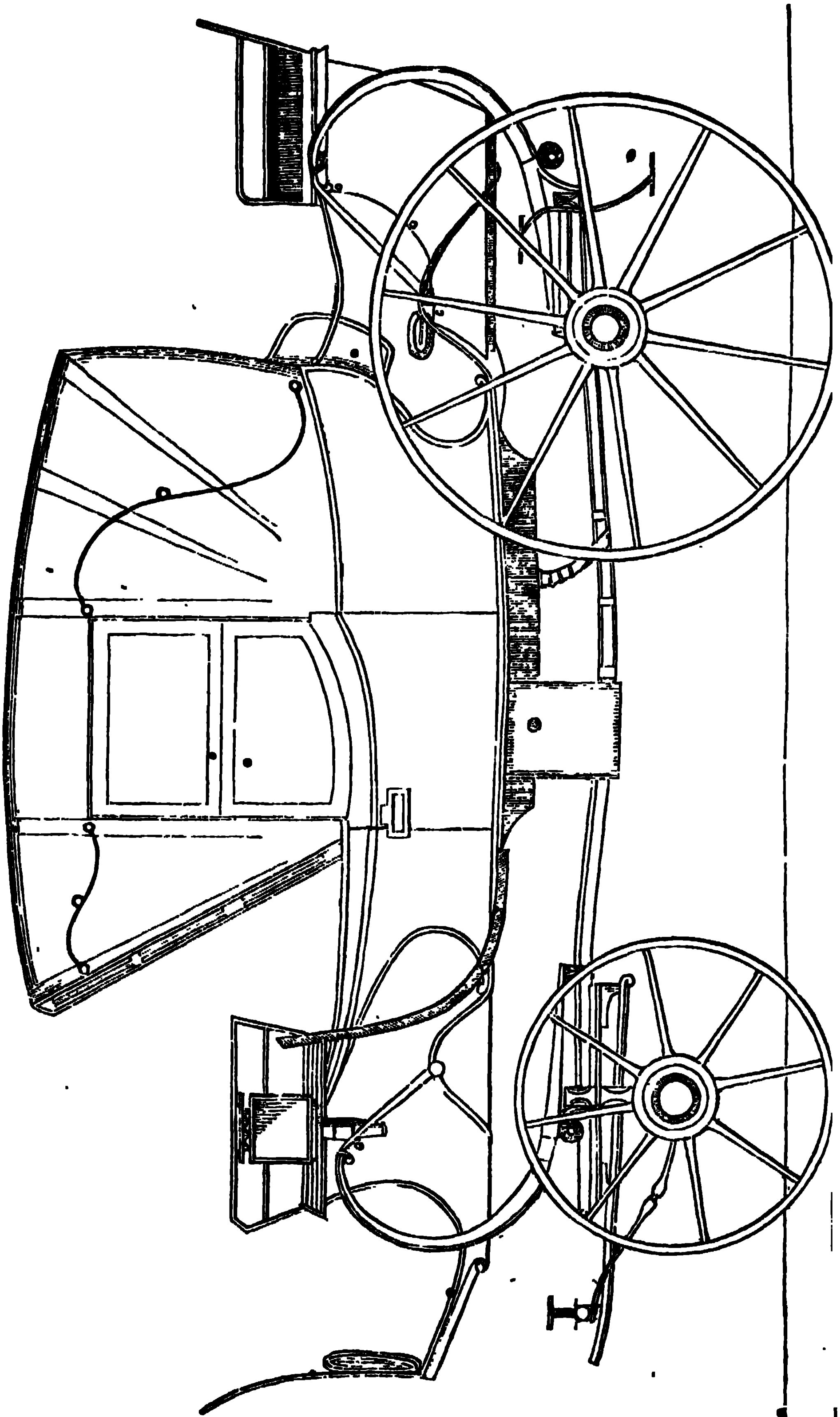
The flap on the front seat falls behind the front elbow rail, and consequently passes through the first bow when the head is up, and only reaches far enough to receive the end of the German shutter. The doors are grooved for double glasses, which are either separate, drawn up, and placed one above the other; or they may be hinged together, and when drawn up, the inside glass is turned down and placed outside of the frame and door-rail.

The bows are set with webbing in the usual manner, and covered with leathers similarly to a half head; the portion of leather between the second and third bows, extends only about 7 inches down the side of the head, the edge being squared with the second and third bows and webbed; a piece of good webbing extending from the second to the third bow, keeps this edge firm. The cloth head lining at the same point is finished on the edge with a piece of pasting lace; in all other respects it is finished like a half head. The tops of the glasses, when drawn up, pass between the leathers on the outside, and the cloth on the inside, requiring no rail to receive them. A pair of joints, extending from the second to the third bows, strike up that portion of the head, and may be placed either inside or outside; other joints extend the head between the hind elbow and the third bow, and between the first and second bow in the same manner. A leather curtain extending across the front, webbed at the corners, buttoning over the top and down the sides of the front bow and along the front elbow rails, closes that portion of the head when the carriage is required for four persons: this curtain may be secured to the top of the front flap and folded up when not in use, or it may be entirely removed or placed in a box under the coachman or footman's seat.

To secure the second and third bows firmly together when the head is down, a notched pin extends from the back of the second bow some 7 or 8 inches from its ends, and a corresponding plate is secured to the front of the third bow.

Suppose the head up, and it is required to be put down: after removing the curtain, or folding up the German shutter, and dropping the glasses into the doors, unbolt the locks or second bow—loosen the joint between the second and third bow—lift the first and second bows across the door when the leather will fall between the second and third bows; in the same manner, insert the

pin of the second bow in the corresponding plate on the third bow, when the weight will secure the head firmly together; it will then resemble a half



head, and may be put down in the same manner. The same course must be observed in raising the head; first extend it as a half head, then lift up the first

and second bows, pass them across the door and bolt them into their places. striking up the joints between the second and third bows, and draw up the door glasses, and unfold the shutter, or put on the front curtain, as the case may be. When the doors are so shallow, that double glasses would not have sufficient height in the doorway, the glass frames may be made of one size and suspended with slip hinges turning out with the door, being bolted to the top for that purpose, and when the head is down they may be placed in a box arranged for them under the rumble or footboard behind, or the coachman's seat in front.

### THE CRANK.

Sir,—I had intended, long since, answering your correspondent M., but unavoidable business has hitherto prevented me. I cannot, however, any longer permit him to suppose, either that he has answered any of my objections satisfactorily, or that he has made out the slightest case of misrepresentation against me.

He has quite misunderstood the latter part of my letter, in supposing I was there alluding to his experiment. If he will look again, he will see that I made no such allusion, but that my remarks there were perfectly general: in fact, Sir, I despatched his experiment with a very short notice, stating that I did not consider the facts he relies so much on, "sufficient for the foundation of any argument," and giving my reasons for this statement; for I really considered it quite foreign to the point at issue, and the inferences he drew from it so *utterly* inconclusive, that I did not care to trespass too much on your columns to expose it; since, however, he still seems as much enamoured of it as ever, I shall now offer you a few additional remarks, which I hope may have the effect, once for all, of putting it *hors de combat.*

I must first remark, that *I did not charge M. with contending* "that when a lesser power held a greater in equilibrio, and no motion ensues, that there must be a loss of power," as he would insinuate; nothing could be farther from what I said: he might undoubtedly perceive, from my letter, that I supposed him to hold these opinions; but my doing so was no *misrepresentation*; *at the worst*, it was a mistake, and a very natural mistake, owing to the tenor of his letter, in which he never once attempted to *account for* the loss in the crank, nor in any way to show *what became of* the power he supposed to be lost; thus leaving every one to conjecture, for themselves, what his opinions on this subject might be: besides, this supposition being correct, or not, does not in the smallest degree alter the meaning of the remarks in any part of my letter.

Your correspondent seems to expect that I should have *attempted* to reconcile the facts given in his experiment with the doctrine of virtual velocities; but really I must decline combating such a fanciful difficulty, or explaining a discrepancy which I cannot perceive, and which he has not proved to exist.

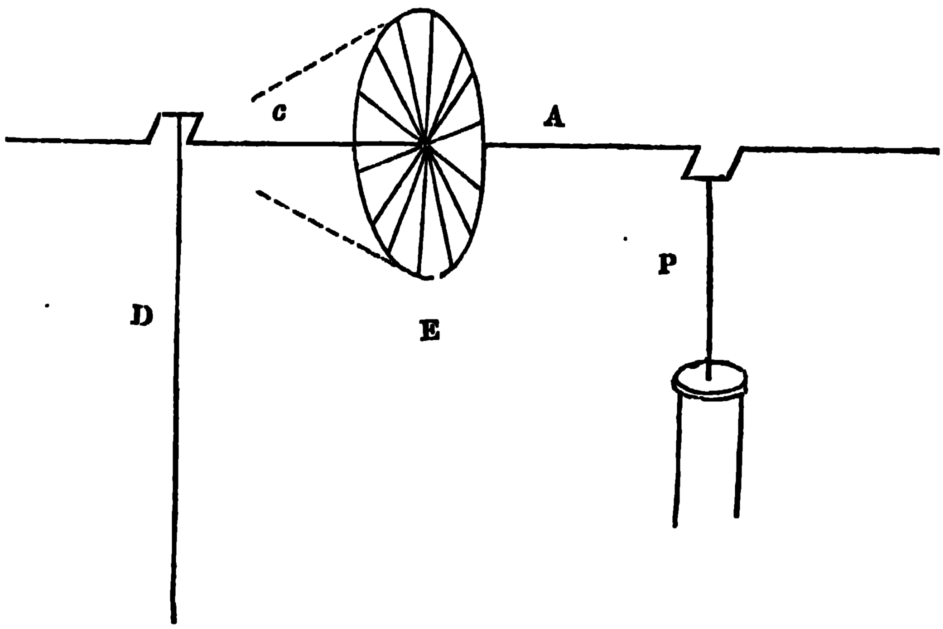
I shall now come to another of my *supposed* misrepresentations. He gives us his experiment, avowedly, to prove that there is a loss of power in the crank; and then shows us that the 56 lb weight was drawn two inches; and when *his crank* came into play, he says, the 28 lb weight was drawn four inches, "as might have been expected." Now, knowing that his expectations were, that this experiment would show a loss of power in the crank, what could any one have supposed, but that the loss was to be seen here, *when his crank was in action?* M. now, however, allows that there was no loss here, so this matter is settled; but I must request him, for the future, to *explain* his opinions *before* he brings charges against any one for *misrepresenting them.*

I shall now proceed to examine the rest of his "facts." He states, (page 264,) "We have, therefore, $56 \times 2$ in. $+ 28 \times 4$ in. $= 224 = 37{\cdot}3 \times 6$ in.; *consequently*, a weight of 37·3 lbs. put on the board *k*, when the bar is drawn back two inches, should be moved over a space of six inches, namely," &c. Such a *non sequitur* as this I never saw! Yet it is the whole life and soul of his supposed loss. Let us just consider it for a moment: here, when the bar comes against the stop *d*, it becomes a lever of the third order, in

which the power acts at half the distance from the fulcrum that the resistance does; consequently, we see that, *to be moved at all*, the latter must be one-half of what it was previously: accordingly, a 28 lb weight is now just capable of being moved by the weight under the table; what, then, Sir, are we to think of M.'s conclusion, that a 37 lb weight *should be moved four inches past* this point, *by the same power applied?* Did he expect his crank should *increase* the power, in the latter part of its action, in the ratio of 28 to 37, *because* in the former part he *diminished its task* in the ratio of 50 to 37!! Let us suppose an engine on a railway, just able to draw a train weighing 560 tons along a level, which ends with an ascending inclined plane; and that, on arriving at the plane, it is only capable of drawing up 280 tons; here, according to M.'s reasoning, we might make it draw up 370 tons, by not loading it with the full 560 tons while it was *on the level;* this, Sir, would be a perfectly analogous case, and clearly shows the absurdity of this reasoning.

I forgot, in my last, to notice another absurdity in M.'s letter, when he *varies his experiment.* I shall give his own words. "I now varied the experiment, and taking the weight of 37 lb off the board *k*, I put another light board on the top of that board, and secured one end of the same to the table, so that the motion of the board *k* would not be impeded, while the upper board, on which I put the 37 lbs., was prevented from moving with it." Friction is here the resistance to be overcome, and this he now *doubles;* for each surface of his moveable board having a pressure exerted against it equal to the pressure of the under side of it against the table in the previous experiment, of course the frictions of the two surfaces now will offer (supposing the surfaces of the boards and table to be equally smooth) a double resistance to the progress of the board: accordingly, the board will scarce move at all in this case, and M. very innocently remarks, "How is this? what makes the loss of power in this case greater than in the experiment previously made?" laying all the blame upon the unfortunate crank, that now refused to work *double tides* at his bidding.

I mentioned an experiment, at the end of my last, which M. has not taken any notice of; I shall therefore describe it a little more fully, accompanying my description with a slight sketch to exemplify what I mean. I shall also give what I conceive to be a conclusion *legitimately* drawn from it.




Let a piston-rod P, be arranged, by means of two equally sized cranks and the axle A, to keep in motion another rod D, so that the rods shall be *simultaneously* at the *extremities* of their strokes: D may be supposed to do any work, where the motion is reciprocative, such as pumping. Now, if we compare,

experimentally or theoretically, the force of P, in any part of its stroke, with that exerted at D, we shall find them exactly equal; this I can hardly think M. will deny, and shall therefore suppose he does not. We now have all the power of P transferred to D, by means of the axle A; it must therefore be all applied to turn that axle: and if we suppose the rod D taken off, and the wheel E attached to A, we shall have all the power of P applied to turn this wheel, and perform any work it may be required to do, (such as turning a grinding-stone, suppose at C); for if we allow that there is any force left here, we must suppose it revived again by the second crank, when we attach the rod D.

And now, Sir, I shall leave M. to ruminate on this, premising that, if he makes any objection to my conclusions, he must not expect a reply for three or four months, as I am on the point of leaving England for about a year, and shall not see any letter of his till two months after it is printed.

I remain, Sir, your obedient servant,

R. W. T.

## PNEUMATIC LAMPS.

Sir,—Having given a place in your No. 929 to my plan of a hydrostatic lamp, I am induced to hand you a description and drawings of two contrivances on pneumatic principles, for a similar purpose and of the same date as the preceding one, which will also, I hope, be found equally correct in their principle of action.

I may observe, that in the accompanying drawings I have given the instruments the most plain and simple form, purposely for the sake of rendering the description of their mode of action more obvious and intelligible, and not such as would be adopted in constructing them.

I wish to notice an inaccuracy in the drawing of the hydrostatic lamp (p. 108, No. 929,) which is calculated in some degree to obscure its mode of action, the more especially as my description is also loosely worded. The tube D is there represented as terminating at the top or upper surface of the small trough, whereas, it should be made to descend to near the bottom of the trough, and it is so represented in the drawing which accompanied my description: for it must be obvious on a little consideration, that the trough could be of no service unless the tube were made to dip or descend into it.

I am, Sir, yours respectfully,

N. N. L.

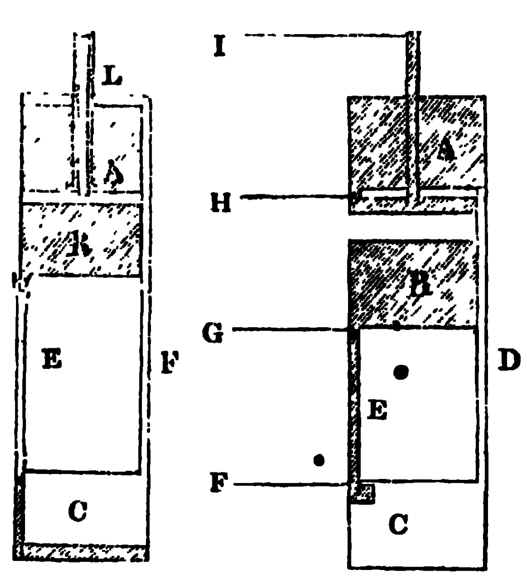
July, 1841.

*Description of two plans for maintaining the oil of a lamp at an uniform level.*

Fig. 1. A is the upper reservoir of a pneumatic lamp, containing the oil which is supplied to the burner through a tube L, rising from near the bottom of the reservoir. Concentric within this tube is another which passes through the bottom of A, and communicates with the reservoir B immediately below it: in other words, it is the central air-tube of a common Argand lamp. B contains the oil required to keep up the action of the lamp, and has a small tube and stop-cock D at the bottom. E is an open tube immediately below D, and descending to near the bottom of the lower reservoir, or air-receptacle C.* F is a tube ascending from the top of C and terminating near the top of A.

*Pneumatic Lamps.*

Fig. 1. Fig. 2.




The instrument being supplied with oil as represented by the shaded parts in the drawing, if the stop-cock D be

* The length of that part of the tube E, which is outside of C, should exceed the whole length of the tube L, through which oil is supplied to the burner.

turned so far as to permit the oil to descend from B drop by drop into the tube E at a rate equal to, or rather exceeding the consumption of oil in the burner, the action of the lamp will continue uniform until all the oil in A is consumed: for there will always be a column of oil in E, equal to the column contained in L, above the surface of the oil in A; because, as the latter increases in height by the sinking of the oil in A, that in E will rise proportionably, the included air of course undergoing an increasing compression as the respective heights of the too columns keep increasing. All this it will be seen is regulated by making the dropping from D to exceed in a small degree the consumption of oil in the burner; and the only effect of too great an excess on this particular will be, that a portion of the oil will overflow at the burner and run down the interior tube into the cistern B; but so far from this being a disadvantage, it will contribute to the vividness of the flame, by bringing a constant supply of oil to the burner.

For practical purposes I apprehend this lamp will be found more useful and manageable than the hydrostatic lamp before described, as only one fluid (oil) is made use of, and it may be carried about like a common lamp without inconvenience from the oscillation of the columns of fluid, and consequent overflowing of the oil, which in this case will only run down into the reservoir beneath.

Fig. 2 is a double fountain lamp acting through a column of compressed air. A is a fountain reservoir communicating with a close compartment below by means of its air hole, shown by a dark spot or circle. From near the bottom of this compartment ascends a tube to the burner; and from near the bottom also another tube D descends, and terminates at the top of the lower reservoir or air-receptacle C. B is another fountain reservoir, its neck, or shank, entering the tube E, which terminates within and near the top of C in a trough or short returning tube.

When the lamp is supplied with oil, as represented by the shaded parts in the drawing, there will be two equal and unvarying columns of oil, F G and H I, held in equilibrium through the medium of the compressed air. As the oil in the burner is consumed, the equilibrium becomes disturbed: a portion of oil descends in the tube E, and is pressed over the edge of the trough, and its place is immediately supplied from B by the admission of a bubble of air. The included air presses on the surface of the oil in the compartment below A, and restores it to its original height in the burner, at the same time uncovering the air-hole of A, into which a bubble of compressed air enters, and displaces a portion of oil from it; and in this manner the action of the lamp will continue as long as there is any oil in A and B.

In constructing this lamp it would be advisable to have an opening at the top of A (for filling it with oil) fitted with an air-tight cap, with which the slides of the air-hole should be so connected by a wire or other means, that when the cap is removed, the slider should cover the air-hole, and when the cap is fixed, the air-hole should be open.

The lamp just described, is in principle nearly the same as Parker's Patent Fountain Lamp; but in that instrument and the drawings of it I have met with, the principle is not fully carried out, and consequently, the action of the lamp is exceedingly imperfect.

N. N. L.

## PILBROW'S CONDENSING CYLINDER ENGINE.

Sir,—I consider it proper to take upon myself to support the observations respecting my engine, set forth in the pamphlet by Mr. Boyman, as that gentleman's occupations will perhaps prevent him. I beg, therefore, to inform S., that the two methods of calculating the expansive effects of steam were known to me, and that the one he mentions is the only correct one; but I permitted, for two reasons, the one to be used, though less correct than that of S.'s—1st, because it is too frequently done, and it has been the custom to calculate items for friction and effect from the joint amount of the height of the column of mercury at the boiler, and at the condenser; that is, from the net value of the steam when the imperfection of the condenser

vacuum has been deducted. Using Tredgold's formula, for convenience, we preferred carrying it through in this way, as he makes the same deductions. 2ndly. The mode adopted by S. would give to my engine a greater advantage than the method used by me; for instance, S.'s mean, for each, of 15lbs., (though I believe he cannot find 14¾,) must have deducted from it 1·5 for imperfection of vacuum in the common engine, leaving 13·5: but from my engine only ·5 must be deducted, (as I get 1 lb better extreme condenser vacuum,) leaving 14·5. The difference, then, in the two will be as 8·95 is to 5·5, indeed as 9 is to 5·57, which is rather in my favour. In adopting the usual way, therefore, I took it against my invention.

And now, may I ask S. his candid opinion of my engine? He speaks of the pamphlet as if it were praised too highly. It certainly is spoken of in terms too flattering to myself, but does it, or does not the invention itself, deserve praise? Mr. Boyman says it is the only original engine of value since Mr. Watt's. He gives a list of all the works upon the steam-engine, and in none could he find its resemblance. Is it so? Alpha, in his papers, has declared that the value of steam will be doubled by using it expansively, to its fullest extent. I am, with him, assured that this advantage will be eventually seen and followed; but I say, even then, when you come to use steam to its utmost possible limit in rotative engines of the present form, my condensing cylinder will still double their duty. Is this so? If it be, I am sure that S., who writes with so much intelligence, will not deem that I can have too warm a supporter. Only let him look at the great changes it must then make among the mercantile shipping, when no ship for an Indian voyage will be unprovided with auxiliary steam power. It will double, for twenty years, the business of every engine-maker in London, or elsewhere, what with the alteration of the present engines upon sea and land, and supplying new ones for merchant ships.

If I am correct, S. will be advancing the cause of science in advocating my engine. If I am wrong, he will lay me under a personal obligation in pointing out my error; for he will save my time, which is my fortune, and my money, which is my stock. I am of those who, whatever sum I had embarked, would feel obliged to any individual for kindly undeceiving me. No sooner did Urwin's engine appear, than, the next week or so, Scalpel denied its value, and Alpha completely refuted its superiority. Why not do so of my engine? I invite comment on it. Mr. Urwin cannot but feel that his first loss is the best, for, unless an invention is sound in principle, it is absurd to think it can be generally used.

One thing is beyond doubt, that the Cornish engines burn 3 lbs. of coal per horse power, and the rotative engines 6½, 7, and 8 lbs. If it is not due chiefly to the superior vacuum, to what else can it be traced? Mr. Brough says that percussive action is "unquestionably one of the great acting causes." In my next I will convince him, I think, that it is impossible percussion can be one. Mr. Parkes found certain facts—it was his province to account for them—and he adopted a theory, of all the least philosophical.

I am, Sir,
Yours respectfully,
JAMES PILBROW.

Tottenham-green, August 2, 1841.

## ON AN IMPROVED SIGHT FOR RIFLES AND OTHER FIRE-ARMS. BY CHARLES THORNTON COATHUPE, OF WRAXHALL.

[Read at the Plymouth Meeting of the British Association, July 3d, 1841.]

The usual mode of constructing the regulating sight of a rifle is, to adapt a piece of steel to a dove-tailed groove filed transversely across the lower end of the barrel; and to furnish this piece of steel with two, three, or four separately moveable leaves of steel, of various heights, each having a notch filed in the centre of its upper edge. These leaves, being attached by means of a hinged joint, can be raised at pleasure; and their heights are generally regulated for certain definite ranges, the lowest being for 100 yards, the next for 150 yards, the third for 200 yards, and the fourth and highest for 250 yards.

Between these stated intervals an imaginary allowance for the correct elevation is all that can be effected.

As a substitute for this description of sight, I beg to recommend another, upon a different principle, equally simple, and by which any elevation may be readily obtained with accuracy, commencing with the lowest, or point-blank range, and ascending by the least possible increments to the extreme range for all useful purposes.

It should be constructed by first forging a piece of iron, which, when filed up flat, and square at the edges, shall furnish a wedge, or inclined plane, from six to eight inches in length, and from three-eighths to half-an-inch in width, having its thicker extremity about three-eighths of an inch, and its thinner end about one-sixteenth of an inch in thickness.

Upon this inclined plane a piece of steel, of similar length and width, and of uniform thickness throughout, having its edges filed so as to exhibit a dove-tail section, must be fixed, the wider surface being uppermost. Upon this dove-tail plate a steel sight, with a small notch filed in the centre of its upper edge, must be fitted so as to traverse steadily from end to end. The dove-tail plate may be attached to the inclined plane by means of gunsmiths' solder; and when thus fixed, a narrow groove must be filed longitudinally through its substance, commencing in a medium line upon its upper surface, the bottom of the groove being parallel to the base of the inclined plane. The whole must then be affixed to the rifle barrel, in a line corresponding with the axis of the bore, by means of three steel screws, whose heads must be countersunk.

It is evident that if the upper edge of this traversing sight, when at the commencement of the inclined plane, be so adjusted to the heights of the inclined plane, and of the sight near the muzzle, that a line passing through a central point in each shall be parallel to the axis of the bore, this will be the position for the point-blank range of the rifle. Also, that if the lower sight be pushed farther along the inclined plane, the angle of elevation, and consequently the range, must be proportionally and gradually increased, until it has traversed to the extent of its limit: and as, during its passage, it will be gradually approximating the upper sight, there will be an increasing ratio of range from the diminishing distance between the two points of sight.

The plate upon which the lower sight traverses should be graduated throughout its length for every ten yards of distance within the range of the barrel, (the charge and quality of the powder being uniform.) By means of the thumb, the sight may be instantly adjusted to accord with the estimated distance of the object from the observer.

## ELECTRO-MAGNETIC PRINTING.—ROYAL POLYTECHNIC INSTITUTION.

On Monday afternoon a public exhibition of an electro-magnetic printing machine took place in the Lecture-room of the Royal Polytechnic Institution, and the occasion called together a numerous and highly respectable attendance. This novel application of electro-magnetism was introduced and explained in a succinct lecture on the subject, and by a comparison between the inventions of Professor Wheatstone and others with the ingenious instrument now for the first time brought under public notice. The principle upon which electro-magnetism has been applied already, not only to telegraphic communications, but also to clocks, &c., is already so generally understood, that an attempt at even a descriptive outline of the explanatory lecture would be almost idle repetition. Suffice it to say, therefore, that the invention which it was the object of the lecturer to describe, surpasses its predecessors in this striking and most important point—viz.: that while previous inventions required the constant attention of some agent at the terminus to which the communication was to be made, this instrument may be left at the terminus wholly unprotected and unwatched, and yet the information communicated from the other extremity of the line would be found legibly in type by the curator, on his return after a short or prolonged absence.

The apparatus consists of a dial-plate, inscribed with the alphabet and numerals, with a revolving hand, worked by ordinary clock-work. On the other side of the room stood the important portion of the invention—that which furnished in type the communication to be sent forth from the dial-plate already described. Between those two machines a connexion (capable of being extended in practice to any length) by means of wire conductors, communicating with two electro-magnets placed on a frame, and connected with a cylinder covered with paper, upon which the type was to leave its impression—an horizontal wheel, in which types to correspond with the letters and figures on the dial were fixed. This wheel was ingeniously brought in contact with an inking roller, and these three portions of the machine were all brought into motion horizontally.

Difficult as it is to describe even a simple piece of machinery, we again essay to describe to our readers the *modus operandi*. The party directing the communication stands at the dial-plate first described, and fixes a peg under the letter desired to be communicated. The index or revolving hand performs its rotation until its progress is arrested by coming in contact with the peg.

A small trigger is then pulled, and the galvanic power brought to bear, by the aid of the communicating wires, upon the two electro-magnets, with their machinery on the second frame, and the letter thus communicated is printed upon the paper affixed to the cylinder.

The operations excited universal admiration, and the machine itself is well worthy the attention of the curious, for though at present it may fail as a speedy means of communicating information in print, still by the adoption of a code of signals (by which one letter or character might be construed to denote a sentence or describe a subject), the invention might be made extremely valuable in the times in which we live.—*Times.*

REMARKS ON PEAT FUEL, BY C. W. WILLIAMS, ESQ., LIVERPOOL.

Being, through the Dublin Steam Company, extensively connected with steam navigation, and having been instrumental in introducing it into Ireland, in aid of inland intercourse on the river Shannon, my attention was drawn, several years back, to the substituting turf for coal, as a fuel for the steam-vessels, on the score of economy and convenience—coal being obtained with difficulty, and at a great expense; while turf abounded in numerous districts along the hundred miles of that river over which the steam-vessels daily passed. A further inducement was, that its adoption as a fuel for steamers would form a valuable and profitable source of employment. The result of the trial has been satisfactory in every point of view.

In the adoption of a turf fuel no small inconvenience, however, was experienced from its great bulk, and, in wet seasons, from its retaining so much moisture as seriously to detract from its heating powers. My attention has long been directed to the remedying these two evils, by obtaining a more condensed and a drier fuel.

As to the means of increasing its density, and thus remedying the evil of its excessive bulk, nothing had been attempted, neither had any effort been made at improving the mode of preparing it for fuel; yet these are objects of great importance. My attention was further drawn to the value of turf, or peat fuel, as it is called in England and Scotland, by the statement, that it had not only the power of giving an intense heat, and with great rapidity, but that it possessed properties which gave it great value when applied to the various processes of metallurgy, and particularly in the working of iron, when the fuel comes in contact with the metal. This led me to pursue the inquiry on another ground, namely, as being likely to supply an improved fuel for the uses of the furnace and the forge.

The well-known superiority and high money value of "charcoal iron," (iron manufactured by means of the heat from charcoal, and which is the leading peculiarity of Swedish iron,) gave a further stimulus to the inquiry. Coke prepared from turf, as being a pure vegetable charcoal, ought, it would appear, not only to possess heating properties analogous to those from wood charcoal, but to be equally free from those deleterious ingredients which abound in mineral coal. Such, indeed, is the value and purity of the iron manufactured by the aid of wood charcoal, in preference to coal coke, as adopted in Great Britain, that we find an extensive company now formed in the metropolis, called the "India Steel Company," established for the purpose of importing iron manufactured by themselves in India by the means of charcoal, in procuring which they have there great facilities, and converting it into steel by the same material in this country. It is to be hoped, that, by such means, the importation of Swedish iron may, ere long, be rendered unnecessary.

In pursuing the inquiry as to the manufacture of turf coke, I fell naturally into the common error of taking the lower portions of the bog in preference to those nearer the surface; and, from this circumstance, that the latter, on account of their lightness, appeared wholly unsuited to the purpose; while the former, from their great comparative density, seemed alone available in producing a coke which could stand the blast. From the lower strata a sufficiently dense coke could be formed, by the aid of suitable cooking stoves; but it was found to be so impure, and impregnated with so large a proportion of incombustible and deleterious matter, as to have an injurious effect on iron, from an acid which it was supposed to contain. From the upper strata, and particularly where they were composed of bog moss, which had made but little progress towards decomposition and solidification, I obtained an exceedingly pure carbon, giving a very small per-centage of useless, and no injurious, matter. This upper portion of the bog, however, was of so light and porous a texture, and so apt to re-absorb moisture, by which its heating properties were much reduced, that it would scarcely repay the labour of cutting and saving, even for domestic fuel; while the lower strata, on the contrary, often approached the solidity of coal. This superior density had been acquired, in some degree, by the decomposition, and consequent solidification, of its vegetable fibre, but still more by the consolidation, through ages, from the pressure of the superincumbent mass, often to the depth of twenty or

thirty feet. But this great density, valuable as it may be, had been obtained at the expense of its purity and heating properties, by the addition of many heterogeneous and incombustible substances; and which, *pro tanto*, and without reference to their chemical effects, deteriorate its calorific power and usefulness as a fuel.

I may here observe, that I have burned the compressed peat coke, which forms the subject of the following analysis, in a small room, in a stove resembling Joyce's stove, standing on the table, for four days and nights successively, during which it was never extinguished, and without any perceptible unpleasant smell or other annoyance.

Now, having thus ascertained that the upper and lighter portions of the bog had the greatest purity and heating power, weight for weight, the difficulty presented itself of combining density with purity, and which, in the natural state, do not co-exist.

In this I have completely succeeded, having obtained a coke, from the lighter portions of the bog, possessing not only double the density of wood charcoal, and equal to that of coal coke, but possessing that purity which is so essential in the working of iron. To ascertain the relative values of the compressed peat, and peat coke, as compared with coal, coal coke, and charcoal, I had a very accurate analysis made by that able experimenter, Professor Everitt, and whose report I here subjoin:—

*Report of experiments on compressed peat, and on coke made therefrom.*

| | |
|---|---|
| DENSITY.—The density or specific gravity of water | 1000 |
| Compressed peat, the thinnest and hardest pressed | 1160 |
| Ditto, the thicker or less pressed | 910 |
| Peat coke, the thinnest or hard pressed | 1010 |
| Ditto, the thicker or less pressed | 913 |
| The resin fuel | 1140 |
| The resin alone | 1110 |
| The hardest and dry woods, such as oak, ash, elm, vary from 800 to | 885 |
| And the lighter woods, such as poplar, pine, &c., from 383 to | 530 |
| Charcoal from hard woods, varies from 400 to | 625 |
| Coals vary from 1160 to | 1600 |

Hence we see, that the hardest compressed peat is denser than the hardest woods, in the relation of 1160 to 885; and, compared with some of the lighter woods, nearly double. Further, that the coke prepared from the hardest-compressed peat is nearly double the density of ordinary charcoal. In common practice, it is reckoned that 100 lbs. of charcoal occupy the same space in a measure as 200 lbs. of coke. The peat coke would, weight for weight, occupy the same, very nearly, as common coke.

*Calorific Power.*—The next point of investigation was the calorific power, as compared to coal, common coke, and charcoal.

The usual method of making assays of this kind is, to burn weighed quantities of the respective fuels, and endeavour to ascertain how much water each respectively will raise a given number of degrees, or convert into vapour. But experiments of this sort, unless made on a very large scale, cannot lead to any comparable results.

It is assumed, from the results of almost all experiments, that the absolute quantity of heat generated, during the combustion of any fuel, is in exact relation to the quantity of oxygen consumed on entering into combination: hence, in order to ascertain the relative calorific powers of fuels, it is only necessary to ascertain the quantity of oxygen each consumes in burning.

The best mode of doing this is to mix a weighed quantity of the fuel with a slight excess of litharge, (oxide of lead,) and find what quantity of metallic lead is reduced. It is to be remarked, that this method cannot be applied to such fuels as contain any volatile matter. According to Berthier (and which also agreed with some trials made by me on the same substances,)

| | |
|---|---|
| 10 parts of pure carbon will give of lead | 340 grs. |
| 10 parts of good wood charcoal, from | 300 to 323 |
| 10 parts of dry woods, from | 120 — 140 |
| 10 parts of good coke, from | 260 — 285 |

It may be here remarked, that assuming the principle, which is the foundation of this mode of assaying, to be correct in practice, it is susceptible of great accuracy; for as every single grain of carbon produces 34 grs. of lead, any error in estimating the lead is reduced to 1-34th in estimating the carbon..

The following results are averages of two, and sometimes three experiments on the same fuel; and in many cases the metallic lead, in two consecutive trials, did not differ more than two grs., which corresponds to only 1-17th of a grain of pure carbon.

| | |
|---|---|
| 10 parts of the peat coke—picked surface peat—gave | 277 |
| 10 parts of peat coke, lower strata | 250 |
| 10 parts of the pressed peat | 137 |

But intensity of heat is often of more consequence than quantity; and intensity depends very much on the density of the fuel. Thus, charcoal can never produce so high a heat as coke; and, in this respect, the denser peat coke and common coke are about equal. These comparisons are quite irrespective of any foreign matter being present which may be injurious to the quality of iron, where the fuel is used for reducing the metal from its ore, or for working iron by fire generally, or when it is used under iron boilers for generating steam.

The above analysis was made on turf from Lancashire; but, from other experiments, I

find the turf from many of the bogs in Ireland exceeding it in purity, and containing a much smaller proportion of incombustible matter.

In considering the foregoing report and analysis, the great density of both the peat and peat coke, though produced from the lighter portion of the surface, is remarkable, the compressed peat being thirty per cent. denser than oak wood, and double that of the lighter woods, while the coke is double the density of charcoal, and on a par with coal coke.

I may here add, that this density, which is so valuable where intensity of heat is an object, may be still further increased, and with little additional expense.

This being the first time that the results of the litharge test, as applied to turf coke, has been communicated in this country, the value of which Berthier, in his elaborate and admirable essay on combustible bodies, has fully established, I may be permitted to say, that its accuracy, and the small amount of practical error to which the process is liable, as shown by Mr. Everitt, gives it a high claim to our attention, although to persons not familiar with the nature of chemical tests it may not be so self-evident. We here see, that the extraordinary attraction which carbon has for oxygen, and the power which it thereby exercises of de-oxidizing metallic oxides, renders the litharge test the most suitable for determining the absolute purity and calorific powers of the various cokes, at least on a small scale, the carbon, under a high temperature, uniting with the oxygen in proportion to its calorific powers; while the lead, being thus deprived of that which is essential to its state of oxide, is precipitated in its pure metallic form, the relative weights so thrown down representing the true combustible values of the several cokes.

We know that many foreign substances enter into the composition of coal and coke, and exercise a very injurious influence over iron and steel in the furnace and forge. In this respect the importance of the peat coke becomes apparent; iron is not only sooner brought by it to a welding heat, but it is found to work softer, and with less of that scaling which is so injurious, particularly in the operation of welding.

These facts I have proved, both in the furnace where large boiler plates are heated, and in the operations of the forge, where even the worst iron was improved in quality.

It is not an unimportant consideration, that peat coke may thus be produced from that portion of the bog which has ever been rejected as a domestic fuel, when a denser kind is to be obtained. Again, that it is precisely that description of turf which most abounds in Ireland, and in most of the large bog districts has hitherto been regarded as an absolute incumbrance; alike unfit for fuel and for conversion to agricultural purposes. This arises from its extreme porousness and levity, its being so far removed from that decomposition which is essential to the vegetative functions of all soils, and also to its susceptibility of the extremes of excessive moisture and excessive drought—overcharged in wet seasons, and amounting to a mere *caput mortuum* in dry ones.

## ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

*** *Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for the purpose.*

THOMAS VAUX, OF FREDERICK-STREET, GRAY'S INN-ROAD, LAND SURVEYOR, *for improvements in horse-shoes.* Enrolment Office, July 19, 1841.

These improvements consist in constructing horse-shoes with moveable caukings, so as to be roughed or unroughed without being removed from the foot. For this purpose, a dovetailed groove is formed in front of the shoe, in which a cauk or projection is secured by a screw; two other similar grooves are formed in the hinder part of the shoe, in which two cauks are held by pins or screws, which are driven into holes formed at the back of the shoe, and bent over at the points.

The cauk in front of the shoe may also be fixed by means of a wedge driven in at the back of it, into grooves formed in the shoe; a pin is then driven through the wedge and through the dovetailed plate of the cauk, and is clenched in front of the shoe.

The shoes may be made either of malleable iron, or of cast-iron made malleable by subsequent annealing.

The claim is, 1. To the mode of constructing shoes of malleable cast-iron, with dovetailed grooves and moveable projections; 2. To the mode of making shoes of wrought iron, with dovetailed grooves and moveable projections, as described.

JOHN COX, OF GORGIE MILLS, EDINBURGH, TANNER AND GLUE MANUFACTURER, *for improvements in apparatus for assisting or enabling persons to swim or float, and progress in water.* Enrolment office, July 19, 1841.

This apparatus, which is intended as a substitute for the webbed feet of birds and animals, and the tails and fins of fishes, consists of two parallel wooden bars, made hollow

and filled with cork; across these, at one end, another bar is fixed, for the person who is floating to rest his head upon; two uprights at the other end of these bars support an axis from which two propellers are suspended. Each propeller consists of two float-boards, hinged to a short upright bar affixed to another longer bar, the upper end of which swings on the axis before mentioned; the float-boards have iron stops to prevent their opening too much when forced against the water. Near the upper ends of the longer bars there are two blocks and straps to receive the swimmer's feet.

The person using this apparatus rests his head on the front bar, and places his feet in the straps; he then propels himself by successively drawing the propellers towards him, and forcing them away from him by means of his feet. The propellers collapse when drawn forward, but expand when forced backward, and present a considerable surface to the water. If it is desired to use the hands as well as the feet, the long bars of the propellers are connected to a handle for that purpose. The patentee describes several other modifications and arrangements of apparatus for this purpose: one of them is provided with a flexible tail of steel, or other elastic material, to which an undulating horizontal motion is to be given by the feet or hands of the swimmer. In another arrangement, a screw propeller is employed! The claim is to the improvements in apparatus for assisting or enabling persons to swim or float, and progress in water as described.

JOHN BARBER, OF MANCHESTER, ENGRAVER, *for certain improvements in machinery for the purpose of tracing or etching designs or patterns on cylindrical surfaces.* Enrolment Office, July 19, 1841.

The cylinder from which the pattern is to be transferred is placed upon a shaft parallel to the cylinder to be etched, supported by two bearings, which project from a carriage. This carriage is held firmly in a proper position upon a bed or planed surface, and is made to traverse along the machine, from one end to the other, by means of a nut connected to a screw, which extends the whole length of the machine.

In order to traverse the pattern cylinder, the screw is made to revolve by means of a wheel provided with a small handle, thereby moving the carriage and pattern cylinder end-ways: this motion being continued, until one of the tracing-points fall again upon the same part, at the commencement of the pattern cylinder, as the other tracer had arrived at on the other cylinder, previous to the traversing.

In order to ensure the accuracy of the traverse of the pattern cylinder, a graduated scale is attached to the carriage of the tracers, and on the carriage of the pattern cylinder a pointer is placed, on a level with the graduated scale; so that the operator can adjust the pointer accurately to the given point on the scale, at each traverse, with greater certainty than he could find any particular point on the transferred design.

The claim is to the combination and arrangement of parts described, for accurately traversing a cylindrical pattern or design to the various and successive parts of the cylinder to which such pattern or design is to be transferred, etched, or traced.

CHARLES BERWICK CURTIS, OF ACTON, ESQ., *for a method, or methods of making signals by self-acting apparatus, to be used on railways for the purpose of obviating collisions between successive trains.* Enrolment Office, July 19, 1841.

All along the line of railway at convenient distances apart on both sides, suitable posts are erected for carrying the signal apparatus. To the side framing of the locomotive engines a forked iron is fixed carrying a curved piece of wood, which by the travelling of the engine is carried over, and in contact with a curved lever arm or trigger, at the end of a horizontal axis placed at right angles to the line of rails; from a short lever-arm at the other end of this axis, rods and levers proceed which connect it with, and communicate its movements to the signal apparatus. The signal itself consists of coloured glasses set in a border frame of any suitable form; the upper portion of the glass is red, and the lower portion, which is the largest, is green. This signal moves up and down behind a fixed screen, the surface of which is painted with three colours, the upper part black, the middle green, and the lower portion red. When a train passes this apparatus the curved piece of wood affixed to the engine presses down, the trigger which by means of the rods and levers presses backward the centre of a three-arm wheel; the moment the engine has passed, a spring brings forward this three-arm wheel, which is mounted on the square end of a horizontal axis turned slowly round by the maintaining power of a weight or spring acting through a train of wheels, and wound up once in twenty-four hours. The three-arm wheel operates on the signal by means of pins projecting from the front of each arm near its end, and when set in motion carries round one of its pins into contact with the tail of a lever and presses it down, causing the other end of the lever to raise the signal with a slow and gradual motion behind the fixed screen. When the signal is raised to its highest position, the further motion of the wheel is prevented by a stop. When the three-arm wheel is

forced back by the passing of a train, the tail of the signal lever is released, and falls by means of a counter balance weight below the screen, a pointer connected with it also descending and standing before the red portion of the screen; the wheel-work now turns the three arm wheel slowly round, and gradually raises the signal behind the screen, during which time the green portion of the signal is visible below it, and the pointer traverses the green part of the screen. By the time the tail of the signal lever has been pressed down upon its stop, the signal will have been quite withdrawn behind the screen, and the pointer will stand before the black part of the same.

On the driver of a succeeding train approaching the apparatus, and seeing the whole of the signal below the screen, and the pointer standing in front of the red portion thereof, he will know that the preceding train has only just passed that spot, and he will wait until the signal is raised behind the screen, and the pointer stands in front of the black part. But if he perceives the green portion of the signal, only, visible, and the pointer before the green part of the screen, he will proceed slowly and cautiously, the preceding train not being sufficiently in advance. If, on the other hand, the engine-driver sees the pointer standing upon the black part of the screen, and the signal is quite out of sight, he may proceed at his usual speed.

At night, a lamp capable of giving a strong light is placed behind the signal.

WILLIAM HUTCHINSON, OF SUTTON-ON-TRENT, NOTTINGHAM, SEED-CRUSHER, *for certain improvements in the manufacture of oil and seed cake.* Enrolment Office, Aug. 3, 1841.

These improvements consist in the manufacture of oil-cakes from barley, beans, peas, tares, wheat, oats, or other grain or pulse, combined with a certain quantity of linseed. The process is as follows: the barley or other grain is first passed through a sieve, and freed from any dirt, gravel, &c., and then ground to meal; to twelve quarters of barley are added nine quarters of linseed, previously crushed between rollers. When well mixed, these ingredients are ground together under vertical stones, until they are reduced to a fine flour, which is then placed in a steam-bath, and heated to 212°. While in the hot state it is taken to an ordinary stamping-press, and subjected to a great pressure, by which all the superfluous oil from the linseed, beyond what is taken up by the barley, is expressed.

It is of importance that the materials should be thoroughly pulverized, otherwise the oil-cake produced is rough in appearance, wants coherence, and is of inferior quality; the better the barley and linseed are ground together, the greater will be the quantity of oil absorbed by the barley, and the better will be the feeding qualities of the cake. The claim is to the manufacture of oil-cakes by the admixture with linseed, of barley, wheat, oats, peas, beans, tares, or other grain, or pulse in the proportions, or about the proportions, and in the manner described.

JOSEPH BUNNETT, OF DEPTFORD, ENGINEER, *for certain improvements in locomotive engines and carriages.* Enrolment Office, August 3, 1841.

These improvements consist, firstly, of an apparatus for regulating the admission of steam to the working cylinders of locomotive engines, which, in order to onward motion, requires that the engineer should have his hand constantly applied to it, and which, the moment his hand is removed from it, closes of itself the openings which regulate the admission of steam into the cylinders, and thereby stops the engine, with any carriages that may be attached to it. Secondly, of certain improved breaks for arresting the progress of locomotive engines, and railway and other carriages. And, thirdly, an improved axle-guard for railway carriages, which allows a compensating movement of the axle when the wheels are traversing curves or irregularities of a line of rails.

1. To the ordinary regulator handle a strong curved spring is applied, the other end of which is firmly attached to the back plate of the fire-box; to the right of this handle a second or supplementary handle is placed, having on its spindle or axis a pulley. A chain from the regulator handle is attached to the pulley. The constant tendency of the spring is, to draw the regulator round into such a position, that its apertures are closed and the steam shut off from the cylinders. When it is desired to turn on the steam, and start the engine, the driver takes hold of the supplementary handle, and turns it in the usual direction, until a sufficient quantity of steam is admitted to the engine to enable it to attain the required speed. By varying the position of this handle, the engine-driver exercises the usual control over the speed o the engine, increasing or diminishing it according to circumstances; but should he from carelessness, from drowsiness, from illness, or from any other cause, relinquish his hold of the handle, the spring instantly closes the regulator, shuts off the steam, and stops the engine.

2. The second branch of these improvements includes five different sorts of breaks, the first of which is adapted for locomotive engines. At the back part of the engine a ver-

tical shaft or spindle works in suitable bearings, having at its upper end a handle, and at its lower extremity a worm, or endless screw, which takes into a worm-wheel keyed upon a horizontal shaft or axle; the latter shaft also carries two pinions, which work into two racks on the ends of two segmental levers placed one on each side of the engine, opposite to the wheels. These racked segments are supported near their farther extremity by two pins placed between and attached to the fire-box and the outer frame of the engine. Two curved steel plates, lying over the trailing and driving wheels, are fastened to the framing of the engine by pin-joints; to the under sides of these plates are bolted two boxes, or segments, filled with wood placed end-ways of the grain: or, instead of the boxes, cushions of leather, or any other suitable elastic or partially elastic substance may be used. These plates and segments are jointed to the racked levers, and when the racked ends of the levers are depressed, the breaks are supported clear of the wheels: but on turning the handle on the vertical shaft, motion is given to the worm-wheel and pinions on the horizontal shaft, which raising the racks and levers, depresses the steel plates, and brings the breaks in forcible contact with the wheels of the engine.

A second description of break, adapted for railway or other carriages, is as follows:—A vertical shaft is placed at the end of the carriage, having at top a handle, and at bottom an endless screw, working into a worm-wheel on a horizontal shaft lying in a central position length-ways beneath the carriage. At the other end of this horizontal shaft a small bevel-wheel works a similar wheel on the top of a short vertical shaft, at the lower end of which there is a pinion lying between and working in two racks. The outside of these racks work against anti-friction rollers, which keep them in contact with the pinion. The racks are prolonged towards the ends of the carriage, and terminate in arms which lay across the carriage, extending from side to side and working upon two guide-bars attached to the ordinary stay of the carriage. To each end of the cross arms, a strong bow is attached, opposite to and parallel with the plane of the wheels. Between the extremities of each of these bows a strong belt of leather or other suitable fabric is stretched, with a provision for keeping it in a state of tension. When it is desired to apply the breaks, the guard turns the handle, which, by means, of the endless screw, worm-wheel and bevel-wheels, gives motion to the pinion, which revolving, causes the racks to traverse outwards, and simultaneously forces all the belts against the peripheries of the wheels, thereby arresting their motion. The belts yielding slightly to the pressure readily adapt themselves to the curves of the wheels.

A third description of break is shown, consisting of a cross bar furnished with collars at each end, through which the buffer-rods are passed, and is attached to a central rod, which passes in an inclined position beneath the carriage in a line directed to the centres of the wheels; at its further extremity this rod is forked, and embraces an elliptical or other spring, which lies horizontally, and is attached to a second cross-bar. Instead of the usual straight rod or stay between the wheels, a curved stay is introduced, the ends of which coincide with the direction of the plane of motion of the breaks, and upon which the ends of the last-named cross-bars work. At the two ends of this bar, directly opposite to the peripheries of the wheels, two segment bars are bolted fitted with wooden segments, or other elastic or partially elastic substance; or two bows and belts are used, as before described. A similar arrangement of cross-bars, springs, &c., proceeds from the other end of the carriage to the opposite wheels thereof. In the event of a carriage thus fitted forming part of a train, and the steam being shut off, or the engine otherwise stopped, it presents an obstacle to the carriages which follow it; the train of carriages being carried forward by their momentum, their front buffers would come in contact with the opposing obstacle, and, being driven onward, would press the breaks upon the hind wheels with a force equivalent to the momentum of the moving mass: while the following carriages of the train pressing upon the hinder buffers of the foremost carriage, would force its break on to the fore-wheels, their own being simultaneously applied to their hinder wheels by the force of impact. By this means, all the carriages in the train will be gradually and silently, but effectually stopped. As soon as the train has been brought to a state of rest, the reaction of the buffer springs removes the breaks from the wheels.

A fourth description of break is described as acting in the same way as the foregoing, its distinguishing peculiarity being, that it is applied to the outside (in front of) of the nearest wheels, instead of to the inside of the farthest ones; a guide being formed for the two ends of the break-bar by the rods forming the ordinary axle-guard stay. This break may also be used as a manual break by employing an apparatus similar to that before described, only substituting a pulley and chains for the pinion and racks, as shown.

A fifth description of break is constructed as follows:—a connecting rod is attached to the inside of the buffer by a collar, the other end of the rod being attached by a pin-joint to the arm of a bell-crank lever. To the

other arm of the bell crank a strong strap or belt is attached, which belt passes over the wheel without touching it, and is affixed to and kept in a state of tension by a strong bent spring. When any resistance meets the buffers, they are forced in and act upon the bell crank lever, drawing the strap or belt down upon the periphery of the wheel, with a power equivalent to the strength of the spring and the force acting upon the buffers.

An arrangement is then shown by which the breaks before described as self-acting may be used as manual breaks. For this purpose a vertical shaft is placed at one end of the carriage, furnished with a handle at top, and having an endless screw at its lower extremity, which works into a worm-wheel on a horizontal shaft; this shaft extends to the centre of the framing beneath the carriage, where it carries a small drum or pulley. To each of the break-bars two radial rods are jointed, the ends of each pair of rods being also connected by a pin-joint; from each of the latter joints a chain proceeds to the pulley, to which they are fastened on opposite sides. When it is required to apply these breaks by hand, the handle is turned, which giving motion to the shafts, turns round the pulley and winds up the two chains, which causes the joints of the radius rods or levers to approach each other, whereby the break bars are made to recede from the centre of the carriage, and the breaks are forced upon the wheels, independently of their self-acting motion.

A mode is also shown by which the break springs may be employed as traction or drawing springs.

3. The third branch of these improvements consists of an improved axle-guard; instead of the axle-boxes fitting tightly within the guides, as is usual, a little play is allowed them. Two strong flat steel springs are hung upon bolts between the plates or stays forming the axle-guides, their lower ends being made to impinge against the axle-boxes with a tendency to maintain them in a truly central position, but yielding to the unequal pressure of the axle in either direction, when traversing curves or irregularities in the lines of rails, and resuming their central position as soon as the cause of deviation is passed. Two set screws pass through bosses between the plates of the axle-guides, by which the pressure of the spring against the axle-box is adjusted and regulated at pleasure.

## NOTES AND NOTICES.

*Fire Escape Accident.*—Shortly after two o'clock on Tuesday morning last, a fire broke out in the first floor of the house of Mr. Turner, No. 17, Red Lion-street, Holborn. By the prompt attendance of the Fire Brigade from the neighbouring stations, the fire was confined to that portion of the premises and speedily extinguished. David Gill, the conductor of Wivell's Fire-escape, while showing off against an adjoining house, was precipitated by the breaking of the machine, from a height of nearly forty feet, and was taken up severely injured about the body, head, and face. His wounds having been dressed by a neighbouring surgeon, he was removed to the hospital, another victim to this nefarious system of public imposition.

*A Cast Iron Lighthouse.*—The necessity for a lighthouse to facilitate the navigation of the windward passage by the Morant-point, in the island of Jamaica, so as to enable vessels to avoid the Morant Cays, a dangerous reef of rocks, 25 miles southward of that point, having been long felt by the authorities of the island, they have determined upon the erection of a tower and lights for that object, upon the recommendation, and under the direction of their consulting engineer, Mr. Alexander Gordon; and it may now be seen in a very advanced state of forwardness, from the Road at Pimlico, erecting on the works of Charles Robinson, proprietor of the long-known establishment of Bramah and Sons. It forms a most conspicuous and imposing object as it rears its head above the surrounding buildings; and when completed to its full height, 100 feet, will doubtless attract much notice from its novelty. The diameter of the base is 18½ feet, tapering gradually to 11 feet under the cap, which supports the lantern containing the lights and reflectors, which, with the actuating apparatus for revolving the lights, are constructing by Deville, of the Strand.—*Times.*

*The Hindostan*, launched at Plymouth on Monday last, in the presence of the members of the British Association, is a 78 gun ship, a two-decker, has been 13 years on the stocks, is teak built, and constructed in the old school, with a bluff bow, adapted to rough weather. The following are her dimensions:—

| | Ft. | in. |
|---|---|---|
| Length from the figure-head to the after part of the taffrail ............ | 217 | 11 |
| Length on the gun-deck ............... | 185 | 8 |
| Extreme breadth ........................ | 50 | 10 |
| Extreme height of the figure-head above lower part of false keel...... | 47 | 4 |
| Extreme height of taffrail above do. | 53 | 9 |
| Depth in hold ............................ | 21 | 0¾ |
| | Tons. | |
| Burden .......................................... | 2,050 | 30-94 |
| Freight when launched ............... | 1,606 | |
| Freight when equipped for sea ...... | 3,213 | |

*Carte's Safety Rocket.*—A few days since a series of useful and interesting experiments were made by A. G. Carte, Esq., at the Botanical Gardens, with his rocket apparatus, for communicating with shipwrecked vessels. The width of the range was fixed at eighty feet; so correct was the firing, that all the rockets passed within a few feet of a flagstaff placed in the centre of the range. The process of firing is not less remarkable for its effectiveness than its simplicity. The rocket is placed in an elevated position, on a frame similar to that of a telescope frame, and the rope is coiled in a box on the ground, in such a manner as to offer no obstruction to the progress of the rocket. So simple is it that two or three gentlemen, previously strangers to the process, were enabled from observing Mr. Cart perform the experiments, to fire some of the rockets with equal effect. Among those discharged during the evening, were two six pounders, carrying a rope weighing 22lbs., and with the exhibition of which the whole company were highly delighted.—*Sheffield Patriot.*

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## TATE'S ELECTRO-MAGNETIC MACHINE.

Fig. 1.

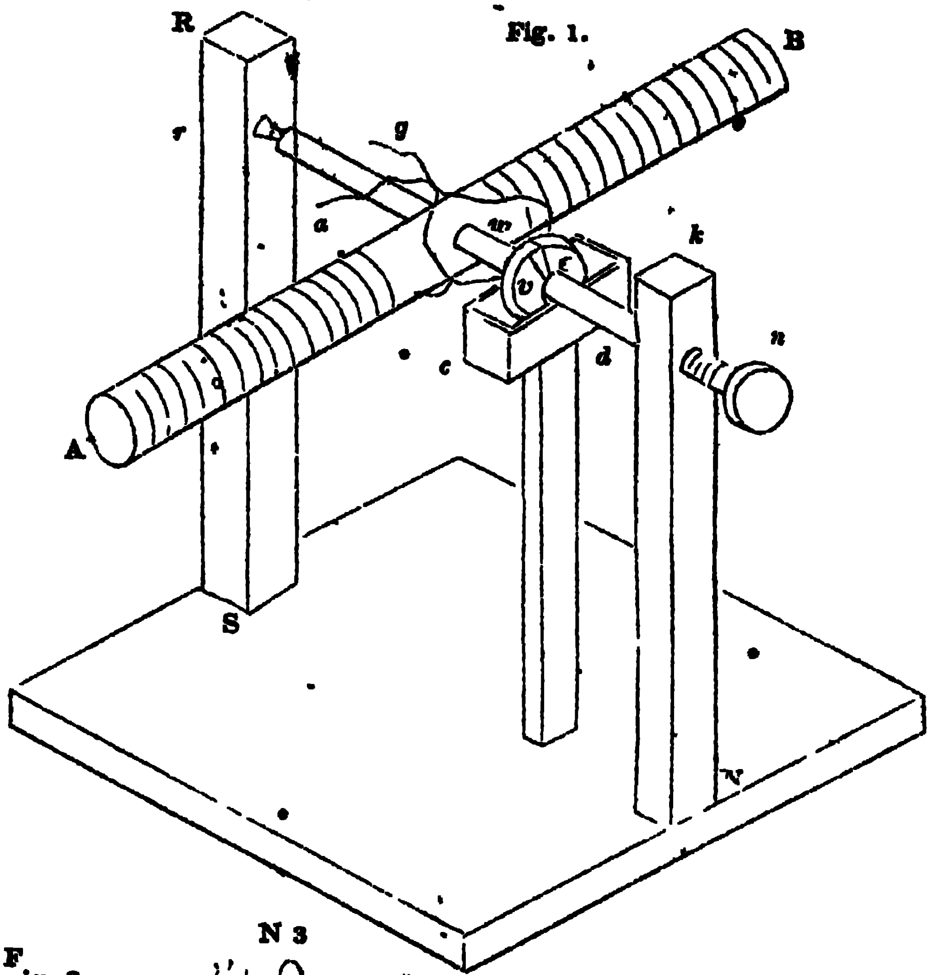



Fig. 3.

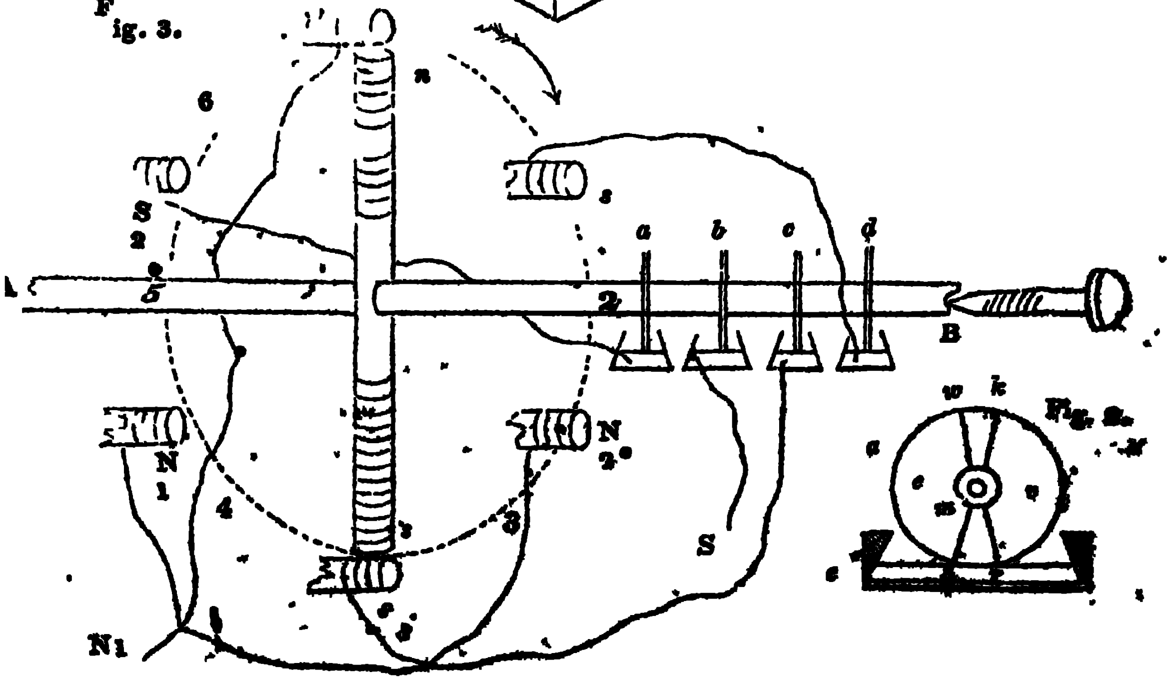



Fig. 2.

## TATE'S ELECTRO-MAGNETIC MACHINE.

Sir,—As public attention seems, at present, strongly directed to the subject of electro-magnetic engines, it appeared to me that an elementary description of an apparatus of this kind, which I put together some years ago, would afford some amusement, if not instruction, to your intelligent readers.

That steam will one day be superseded by the galvanic power, in those countries at least where coal is expensive, scarcely admits of a doubt. Galvanic engines have certainly not yet attained their most simple and effective form; yet the subject merits the highest attention of our monied speculators. The history of the arts shows, that there exists a wide interval between the first and grand conception of a great invention, and the final and complete realization of that invention in the world of industry. Between the first application of steam as a moving principle, and the epoch of our double-acting steam-engine, there elapsed upwards of a century. It is, therefore, not unreasonable to expect that the galvanic engine will one day, and that perhaps not distant, be rendered available for all the purposes of machinery. After making considerable allowance for the sanguine expectations of interested inventors and speculators, the attempts of various mechanists appear to have been crowned with encouraging success.

The novelty of the model which I am about to describe consists in the employing of a more simple and efficacious means of reversing the poles of the magnets, than that which is made use of in the engines of Davenport and others. In these, the connexion of the galvanic circle is made by means of a wire rubbing against a wheel or metallic surface: by this contrivance it is evident that you cannot have such a perfect contact as when mercury is employed; and besides, the friction occasioned by this rubbing, forms, in small engines, a considerable part of the resistance to be overcome. Dr. Ritchie's rotating magnet is certainly not liable to the above objections; but in practice it is found, that, when the speed of the magnet becomes great, the mercury floats over the breaks, and thus defeats the purpose of the contrivance.

I proceed to describe the simplest form in which the model alluded to may be made; and then I shall afterwards show how its power may be increased to an almost indefinite extent.

A B, in fig. 1, is an electro-magnet, which revolves upon a horizontal axis *a a*, the hollow ends of which turn on the conical or pointed extremities of the screws *n* and *n*, which pass through the uprights *k* N and R S. To the axis is fixed the disc *w v e*, composed of two nearly semicircular rings, of very thick copper, *v* and *e*, insulated as well with respect to each other, as with respect to the axis; the break at *w*, and the point opposite, are exactly filled up with ebony. The edge of this disc, which is smoothed and rounded off, dips into, or rather touches, the surface of mercury contained in the cup *c*, the interior of which is of a conical figure. There is a precisely similar disc and cup on the other side, *a g*, of the magnet, which, for the sake of simplicity, is omitted in the figure. The breaks upon *a g* have the same position as those upon *w*. By this contrivance, the disc turns smoothly on the mercury, without producing much agitation, or throwing any of it out of the cup, which would inevitably be the case were the edge of the disc jagged. To maintain the mercury at the same level, or to supply any accidental waste, the cups may be made to communicate with a larger vessel of that fluid. An enlarged view of this part of the apparatus is shown in fig. 2, where *w e s m*, and *r k*, are the two sectoral rings, both of which are just touching the surface of the mercury at *s* and *r*, that is, when the poles are about to be reversed. The extremities of the magnetic coils are soldered to the sectors *e* and *v*, whilst wires from the sectors at *g* and *a*, cross over to the wires *e* and *v*, proceeding from the sectors situate on the opposite side of the axis *a d*, so that the plate *g* has the same electricity as *v*, and *a* the same as *e*.

The magnet is set in motion in the following manner. The cups at *c* and *a* are connected with the opposite poles of a battery, which causes A B to become a magnet when drawn a little out of the horizontal position. Corresponding poles of magnets are placed at A and B, which occasions A B to fly round, for the first quadrant, by the repulsion, and during the second quadrant by the attraction, of the magnets; when the position of A B is reversed, the ebony at *w* is brought in contact with the mercury, and a little further motion brings

the other sector in contact; and thus the poles of the rotating magnet are reversed, and the pole which an instant before attracted, now repels the revolving magnet, and so on. The open form of this model renders it highly eligible for the table of the lecture-room.

A small machine on this principle, having the soft iron bar five inches in length, and three-quarters of an inch in diameter, revolved at an amazing speed, with a very small surface of zinc.

Let us now see in what way the power developed in this simple apparatus may be increased. Upon the axis *a d*, and parallel to each other, are placed two revolving magnets, such as A B; the magnetic current is therefore split between these magnets in such a way, that opposing poles lie towards the same side; by this arrangement, both poles of the stationary magnets are brought into action at the same time. There are six of these placed horizontally and symetrically, that is, with their poles alternately north and south, in the circumference which the revolving magnets describe, so that these are acted upon more equably for the whole course of their revolution. To suit this extension of the apparatus, the discs have six breaks, each of which is similar in construction to those already described; so that, whilst the revolving magnets are brought opposite to the poles of the stationary ones, the polarity of the former may be at the same instant reversed. It will be found necessary, in this case, to make the discs at least three inches in diameter. Perhaps it may not be unworthy of remark, that the number of magnets, and consequently of breaks in the discs, must be some number in the series, 2, 6, 10, &c., to $4n + 2$, where $n$ may be any whole number: for, let $m$ be put for the number of magnets, then

$\frac{m}{2} + 1 =$ the number contained in the semi-circumference, which must always be even, in order that a north and south pole may succeed and oppose each other; hence,

$$\frac{m}{2} + 1 = \text{even.} \qquad \text{Or, } \frac{m}{2} = \text{odd.}$$

$$\therefore \frac{m}{2} = 2n + 1, \text{ where } n \text{ is any whole}$$

number; whence $m = 4n + 2$.

By this small machine, with very little zinc surface, and under other disadvantages, ½ lb could easily be raised 2 feet high in one minute, or, what is the same thing, 1 lb one foot high in that time. Now, as the magnetic power has been shown to increase with the square of the zinc surface, it follows that if twenty plates, containing each ten times the zinc surface, were employed, and the parts of the engine in other respects proportioned, we should have $(10 \times 20)^2 = 40{,}000$ units of work, which divided by 33,000 would give upwards of one horse power. From this it appears, that it is not difficult to generate an enormous power by the electro-magnetic engine.

After I had made trial of the apparatus which has just been described, it occurred to me that a considerable augmentation of power might be gained by employing electro-magnets, as well for the fixed as for the rotating ones. Since it seems in general expedient to have a greater number of fixed than rotating magnets; and as, in this case, a certain number of the fixed magnets will continue in action when they are not wanted, and thereby waste the moving principle—it is therefore highly desirable, that only those magnets should be in action which are required by the apparatus. The following arrangement appears to possess considerable advantages, the peculiarities of which consist in the method for reversing the poles, and in the keeping of those magnets only in action, which are effective in turning the rotating magnet.

$N_1, S_1, S_2, N_2$, and $N_3, S_3$, (see fig. 3,) are three similar horse-shoe electro-magnets; within these an electro-magnet $n\ s$, revolves on the axis A B, upon which the discs $a, b, c$, and $d$ are fixed, dipping into their respective cups, in the manner already described. Wires proceeding from the poles $N_1$, $N_2$, $N_3$, are soldered to the wire N, passing from one of the poles of the battery, the other pole of which is in connexion with the cup $b$. The opposite poles, $S_1$, $S_2$, $S_3$, are in connexion with the three cups, $a$, $c$, and $d$, as shown in the figure. The disc $b$ has six breaks, the opposite sectors of which are connected by a wire; each of the discs $a$, $c$, and $d$, has two metallic sectors, containing each 60°, placed on opposite sides of the disc, yet joined with each other: the remaining part of the circumference is filled up with ebony. These three sectors are so placed, that only one comes in contact at a time; and each is also joined, by a wire, with that sector on $b$ which comes in contact with the mercury at the same instant. The poles of

the revolving magnet are reversed at the six poles of the stationary magnets by discs and cups, exactly in the same manner as described for the last engine. When *n s* comes to the position 1, 4, the horse-shoe magnet $N_3$ $S_3$ is thrown out of action, and $S_1$ $N_1$ is brought into action by the sectors on *d* and *b*, which are joined to each other by a wire, both coming into contact with the mercury; this connexion is continued until the revolving magnet comes to the position 2, 5, when $S_2$ $N_2$ is brought into action by the sectors on *b* and *a*, which are also joined by a wire coming into contact with the mercury; this connexion is kept up until the magnet attains the position 6, 3, when $N_3$ $S_3$ is again brought into action, by the sectors on *b* and *c* coming into contact with the mercury. The magnet *n s* having performed a semi-revolution, the machine is now precisely in the same state as when the motion commenced, since the opposite sectors on each disc are joined by a wire; the same process, therefore, is repeated for every succeeding semi-revolution.

If there were three or more rotating magnets, the above arrangement would not be necessary, as none of the stationary magnets would then require to be suspended. Another rotating magnet, placed at an angle of 30° with respect to *n s*, would render the motion more equable, for when the one is at the dead points, the other would be effective.

I am, Sir, yours, &c.
Thomas Tate,
Late Lecturer on Chemistry in the York School of Medicine.

Aug. 2, 1841.

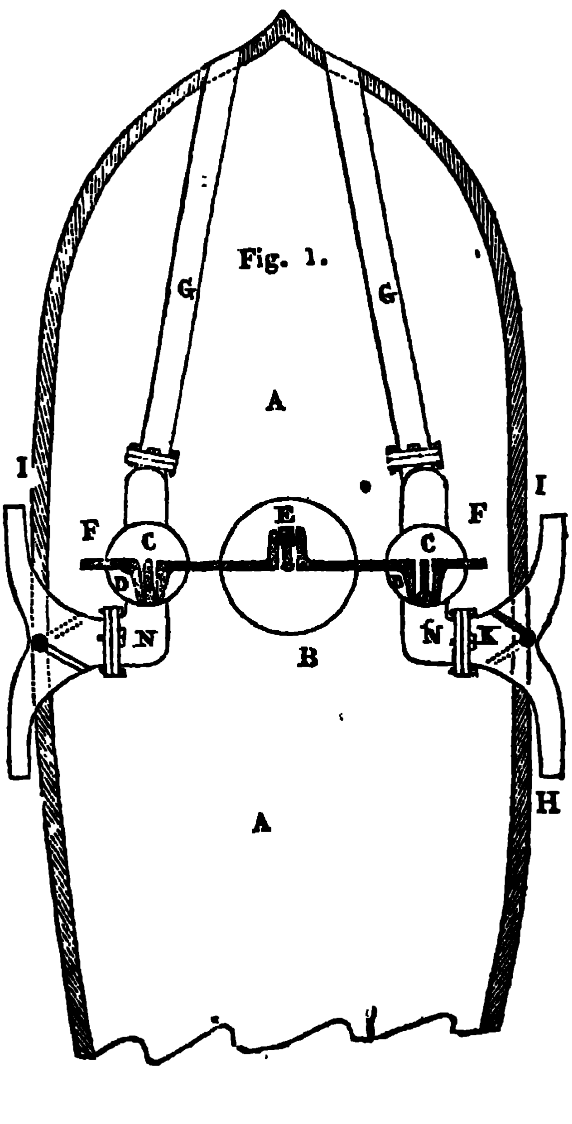
## NEW MODE OF PROPELLING STEAM-BOATS BY JETS OF WATER.

Sir,—Should you think the following method of propelling steam-vessels without paddle-wheels worthy of insertion in your Magazine, I would beg the favour of an early place for it; and if your readers should derive any information or amusement from it, I shall feel myself extremely happy in having contributed my mite towards the benefit of my fellow-men, who, I hope, will excuse me for not giving them a lengthened or learned explanation, as the hammer is oftener in my hand than the pen.

I am, Sir,
Your humble servant,
William Dickson.

Centre-street, Tradestown, Glasgow.
July 10, 1841.

A A (fig. 1) represents a plan of the boat; B, cylinder of the steam-engine; C C, two double-acting pumps, as shown in fig. 2, attached to the engine by the cranks D D, on the end of the main shaft F F; the crank E being connected to the piston-rod of the steam cylinder, puts the others in motion. G G are two pipes passing through the bows of the boat, as low as possible, on purpose to have the mouths of the pipes always below the surface of the water: these pipes being connected with the pumps C C, the water is drawn in at the prow of the boat, and discharged by the curved pipes H H, at the sides of the vessel, when it is wanted to go

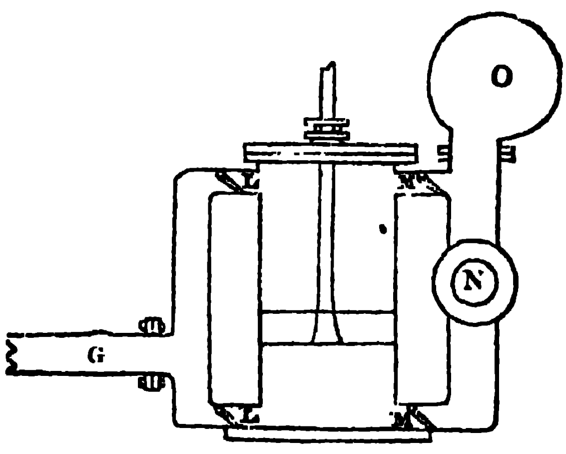


a-head; and when it is wanted to back the vessel, the two valves must be placed in the reverse position, as the one marked K, and the water discharged by the pipes I, I; or if it is wanted to turn the vessel about, the one valve must be put one way, and the other the contrary way, as shown in the drawing. Or the vessel could be stopped altogether, without stopping or slackening the engine, by placing the two valves so that equal quantities of water may be discharged from all the four branch pipes, H H, I I. The valves could very easily be made so that a person could work them upon deck, either by a lever, or wheel and pinion, with an index to point to the direction in which the boat is wanted to go.

*Description of Pump.*

Fig. 2. G, is a pipe for supplying

Fig. 2.




water to the double-acting pump; L L, two valves opening inwards; M M, two ditto, opening outwards, so that the water drawn by the pump is discharged at the pipe N, attached to the curved pipes at the side of the boat. O is a capacious air-vessel, placed on the discharging pipe, between the pump and the curved pipe, wherever it is most convenient. The discharging valves of the pump, and the pipe connected with the curved pipes, should be as large as possible, on purpose to let the water flow with as little friction as possible toward the jet, which should be contracted gradually towards the end, as shown in the sketch.

Now, supposing that each of the two pumps discharge 1750 cubic feet of water per minute, through the branch pipe H, whose area at the end is 93 square inches: the water will then be discharged with a velocity of 2610 feet per minute, or 30 miles per hour, with a pressure of 13½ lbs. on every square inch of the area of the jet, which is 93 multiplied by 13·6, which gives 1264·8; and this multiplied again by 2610, the velocity of the water in feet per minute, and divided by 44,000, gives 75, which is the number of horse power of one jet; consequently, both jets will be reacting on the vessel with a power equal to 150 horses, at 30 miles per hour.

## MECHANICAL DRAWING COPY-BOOK—WANTED.

Sir,—It must be very evident to yourself, as well as to your numerous readers, that the present talent for mechanical drawings is sadly left without culture; and so lamentably is the neglect in this way, that with strong wishes to teach this art among the other branches of a mechanic's education, I cannot discover that there are drawing copies to be obtained at any of the booksellers or drawing implement depots.

Can you or your readers inform me of such, and where they can be obtained? Perhaps I ought to complete my inquiry, by describing what I should require progressive lesson books—on outlines of machines and machinery, and also shaded and perspective copies. Who among your readers ever saw a couple of cog-wheels in gear—shaded and illustrated in a drawing copy-book? Or even a lever on a centre? Of course, excepting the Treatises on Linear Perspective, &c., whose names and excellences are rather out of reach of the copying tyro.

Yours respectfully,

DEGO.

London, July 23, 1841.

## A NEW ARRANGEMENT FOR MARINE STEAM-ENGINES.

Sir,—I shall feel obliged by your inserting the enclosed drawing with references, in your valuable periodical, and remain your obliged,

S. C.

London, May .., 1841.

Fig. 1 is a sectional elevation, and fig. 2, a plan of a new and compact mode of arrangement particularly applicable to marine engines.

*a* is the steam cylinder; *b* a smaller cylinder fixed in the centre of the steam cylinder; *c c*, the piston; *d d*, the piston rods; *e*, the crosshead; *f f*, rods uniting the crosshead with the guide-block *g*, which moves in the small cylinder *b*. From a pin in the guide-block the connecting rod *h* is connected with the crank. The air-pump and other parts may be attached to the engine in various convenient ways.

Fig. 1.

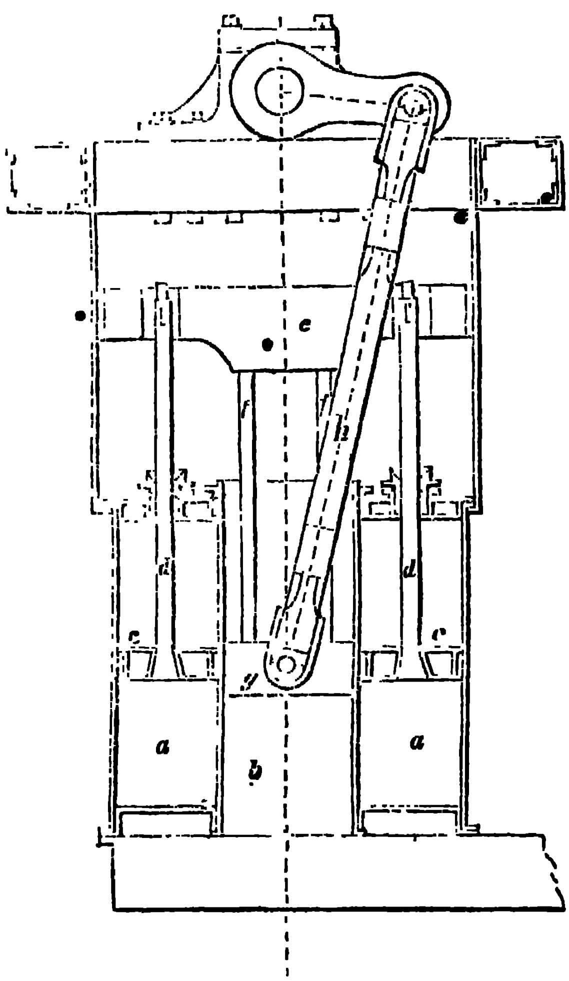
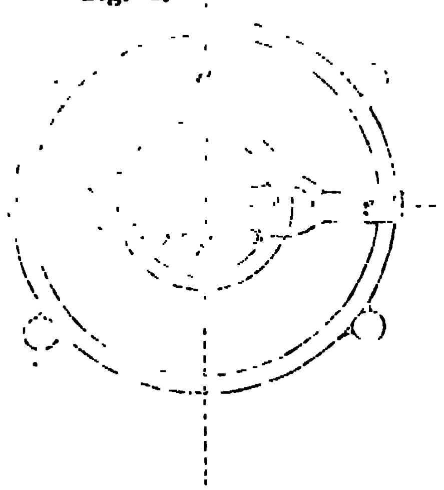



Fig. 2.



## ON THE GENERATION OF SMOKE.—BY CHARLES WYE WILLIAMS, ESQ., LIVERPOOL.

(Being the substance of Lectures delivered by Mr. Williams, at the Victoria Gallery, Manchester.)

A consideration of the nature of those products into which the combustible constituents of coal are converted in passing through the furnace and flues of a boiler, will enable us to correct many of the practical errors of the day, and ascertain the amount of useful effect produced and waste incurred. These products are—

1st, Steam—highly rarefied, invisible and incombustible.

2nd, Carbonic acid—invisible and incombustible.

3rd, Carbonic oxide—invisible but combustible.

4th, Smoke—visible, partly combustible, and partly incombustible.

Of these, the two first are the products of perfect combustion; the latter two of imperfect combustion.

The first,—Steam, is formed from that portion of the hydrogen (one of the constituents of coal gas) which has combined chemically with its equivalent of oxygen from the air, in the proportions of one volume of hydrogen to half a volume of oxygen; or, in weight as 1 is to 8.

The second,—Carbonic acid is formed from that portion of the constituent carbon, which has chemically combined with its equivalent of oxygen, namely, in the proportion of 16 of oxygen to 6 of carbon in weight, or, in bulk, of one volume of the latter to two of the former.

The third,—Carbonic oxide, is formed from that portion of the carbonic acid, which being first formed in the furnace, takes up an additional portion of carbon in its passage through the ignited fuel on the bars, and is then converted from the *acid* into the *oxide* of carbon: thus changing its nature from an incombustible to a combustible. This additional weight of carbon, so taken up, being exactly equal to the carbon forming the carbonic acid, necessarily re-

quires for its combustion, the same quantity of oxygen as went to the formation of the acid.

The fourth,—Smoke, is formed from such portions of the hydrogen and carbon of the coal gas as have not been supplied or combined with oxygen, and consequently have not been converted either into steam or carbonic acid. The hydrogen so passing away is transparent and invisible; not so, however, the carbon, which, on being so separated from the hydrogen, loses its gaseous character, and returns to its natural and elementary state of a black pulverulent body; as such it becomes *visible*, and this it is which gives the dark colour to smoke.

Not sufficiently attending to these details, we are apt to give too much importance to the presence of the carbon, and have hence fallen into the error of estimating the loss sustained by the depth of the colour which the smoke assumes, without taking any note of the invisible combustibles, hydrogen or carbonic oxide, which accompany it. The blackest smoke is therefore by no means a source of the greatest loss, indeed it may be comparatively the reverse, the quantity of invisible combustible matter it contains being a more correct measure of the loss sustained than could be indicated by mere colour. This will be still more consistent with truth, should any of the gas (carburetted hydrogen) escape undecomposed or unconsumed, as too often is the case.

In the ordinary acceptation of the term smoke, we understand *all* the products, combustible and incombustible, which pass off by the flue and chimney. When, however, we are considering the subject scientifically, and with a view to a practical remedy against the nuisance or waste it occasions, we must distinguish between the gas as it is generated, and that which is the result of its imperfect combustion: in fact, without precision in terms and reasoning, we disqualify ourselves from obtaining correct views either of the evil or the remedy.

Now let us look at this gas which we are desirous of converting to the purposes of heat, under the several aspects in which it may be presented under varying degrees of temperature or supplies of air.

In the first instance, suppose the full equivalent of air to be supplied in the proper manner to the gas, namely, by small jets,—for in this respect the operation is the same as if we were supplying gas to the air, as in the Argand gas lamp. In such case, one-half of the oxygen absorbed goes to form steam by its union with the hydrogen, while the other half forms carbonic acid by its union with the carbon. Both constituents being thus supplied with their equivalent volumes of the supporter, the process would here be complete: perfect combustion would ensue, and no smoke be formed: the quantity of air employed being ten times the volume of the gas consumed.

Again, suppose that but one-half, or any other quantity less than the saturating equivalent of air were supplied. In such case the hydrogen, whose affinity for oxygen is so superior to that of carbon, would seize on the greater part of this limited supply, while the carbon losing its connexion with the hydrogen, and not being supplied with oxygen, would assume its original black solid state, and become true smoke. The quantity of smoke would then be in proportion to the deficiency of air supplied. But smoke may be caused by an *excess* as well as a deficiency in the supply of air. This will be understood when we consider that there are *two* conditions requisite to effect this chemical union with oxygen, namely, a certain degree of temperature in the gas, as well as a certain quantity of air; for unless the due temperature be maintained, the combustible will not be in a state for chemical action.

Now let us see how this condition as to *temperature* may be affected by the quantity of air being in excess. If the gas be injudiciously supplied with air, that is by larger quantities or larger jets than their respective equivalent number of atoms can immediately combine with, as they come into contact, a cooling effect is necessarily produced instead of the generation of heat. The result of this would be, that although the quantity of air might be correct, the second condition, the required temperature, would be sacrificed or impaired; the union with the oxygen of the air would not take place, and smoke would be formed.

Thus we perceive that the *mode** in which the air is introduced, exercises an important influence on the amount of union and combustion effected, the quantity of heat developed, or of smoke produced; and in examining the mode of administering the air, we shall discover the true causes of perfect or imperfect combustion in the furnace, as we see it in the lamp. This circumstance, then, as regards the manner in which air is introduced to the gas, (like the introduction of gas to the air,) demands especial notice, as the most important, although most neglected, feature in the furnace. These are,—

* This is a point which is very apt to be overlooked by persons not fully aware of its importance, though we are glad to observe Mr. W. continually presses it on the attention of his hearers and readers.—Ed. M. M.

1st, Expelling the bituminous constituents from the coal, in the form of gas: that is, converting them from the solid to the gaseous state. This is effected by their absorption of heat.

2nd, Decomposing this gas (carburetted hydrogen), and resolving it into its constituents, hydrogen and carbon; thus preparing each for union with its respective quantity of oxygen, according to its own specific law and measure of affinity. This is effected by a further absorption of heat.

3rd, Raising these two combustibles to the temperature respectively required for chemical and electrical action. This also is effected by a still further absorption of heat.

I may here stop to observe that this is the stage of the process at which light is given out, and which is almost exclusively attributable to the radiation from the ignited and minutely divided carbon, the atoms of which are then at the highest possible temperature: a temperature, as Sir H. Davy observes, beyond the whitest heat of metals. If, however, these elementary atoms of carbon be not supplied with oxygen at this juncture, they are quickly carried away by the current and their own diminished specific gravity, and soon losing the required degree of temperature, become unfitted for chemical action, and form the black matter of smoke and soot.

4th, Producing atomic contact (technically called diffusion) between the oxygen of the air and the atoms, hydrogen and carbon, then liberated from that union which had before constituted them an hydro-carbon gas.

5th, Effecting the chemical union of those bodies, or so many of their elementary atoms as have obtained contact with their respective equivalents of oxygen, and in as rapid succession as such contact may be obtained. This latter process alone is combustion, all the preceding ones being merely preparatory. This is the process in which the respective electricities of the combining elements are exchanged, when heat is developed, and when new and distinct bodies are chemically formed.

We perceive throughout the whole of these several stages, that the combustibles, in their progress towards combustion, are uniformly absorbing heat, the last stage alone being that in which new heat is generated; and which, in its turn, is to impart the required temperature to other atoms as they successively enter on a similar course. We see also that the interruption of this progression at any one stage involves the escape, either of the compound gas or its elementary atoms, and their conversion into smoke.

We see, then, how palpably erroneous is
smoke, once formed, can be
the furnace in which it is ge-
how irreconcilable is such a
result with the operations of nature. The formation of smoke, in fact, arises out of the failure of some of the processes preparatory to combustion, or the absence of some one of the conditions which are essential to that consummation from which light and heat are obtained. To expect, then, that smoke, which is the very result of a deficient supply of heat, or air, or both, can be consumed in the furnace in which such deficient supply has occurred, is a manifest absurdity, seeing that, if such heat and air had been supplied, the smoke would not have existed.

*(To be continued.)*

## RUSSELL ON STEAM AND STEAM NAVIGATION.

*On the Nature, Properties, and Applications of Steam, and on Steam Navigation. From the Seventh Edition of the Encyclopædia Britannica. By John Scott Russell, M.A., F.R.S.E., Vice-President of the Society of Arts for Scotland, &c. &c. &c.* Edinburgh: Adam and Charles Black. 378 pp. 12mo., with 15 plates.

(Second Notice.)

The extracts we gave in our first notice of this work are sufficient to satisfy any unprejudiced reader that Fulton was neither the inventor in idea, nor the first who practically established Steam Navigation: yet we cannot content ourselves with these extracts. We saw, in a Report on Egypt and Candia a short time back, that the author, an Englishman, was asked by Mehemet Ali who was the inventor of that wonderful power Steam Navigation? "I told him an American." Such is fame! Now we hold it disgraceful that an Englishman should be so little acquainted with the rise and progress of the arts and sciences in his own country, especially such a science as Steam Navigation, as ignorantly to spread the fame of another in a distant land, and we consider it equally derogatory in the conductor of a public work, who at any time allows a proper opportunity to pass unnoticed to establish the truth. Though we in England are generally careful enough to insist on our rights in this respect, yet we are so teeming with illustrious names in every department of science, literature, and the useful arts, as to have become indiffe-

rent at times to the accumulations; and thus we have let America in this instance, blazon her pretensions in Fulton to such an extent, that even in our own country we find the greater number impressed with the belief, that we are indebted to the New World for one of our greatest blessings.

Few individuals deserve more the reprobation of mankind; none, assuredly are less entitled to our consideration in discussing their merits; than those who seek, from some morbid craving for notoriety, to attract notice to themselves as the champions of their country's honour to an invention which does not belong to it. An attempt to falsify dates, and to misrepresent the clearest evidence, to effect an object which is sure, in the long run, to be exposed, with disgrace to the author, is one of those singular distortions of the human mind which is as frequently found associated with talent, as with the poorest intellect. They seem to delight in employing their talents to divert truth from its aim, when the grave has set its seal upon reply, and prevented the individual whose just fame is assailed, from giving direct and positive refutation of the calumny. The laws of society do not reach murderers of this class, it is true, but the morality of opinion does; and a well-constituted mind, we are sure, will form but a poor estimate of writers, guilty of so great a moral delinquency. The obligation, indeed, to do justice to the memory of the dead, and particularly to so rare and mysterious a quality as genius, is of a peculiarly solemn nature, and in all times and countries, savage and civilized, has been of universal observance.

The unhappy perversion of these obligations by injudicious friendship, the *amor patriæ*, and the still less excusable motives of envy and prejudice, call upon us, at all times, to give our assistance to vindicate the exertions of our ingenious mechanics, to keep alive the remembrance of their genius, and to advocate their claims on the gratitude and assistance of their country for the vast benefits it has derived from their talents. Adorned by the great triumphs they have achieved in the useful arts, and raised by them to an eminence no nation in past or modern times ever rivalled, Great Britain has not frequently refused relief to their wants. From their ranks have sprung the Brindleys, Arkwrights, Comptons, Watts, Telfords, and Symingtons, mighty men of renown, from whose brains have flowed the wealth of untold millions, and the comforts and convenience of generations. Some have raised themselves by fortuitous combinations of circumstances, to great affluence, and have become the gods of genius; others, less fortunate, have lived its slaves, and died in poverty and neglect—leaving to their unhappy families but ruin as their inheritance, and too frequently the task, which they have not the means of performing, of rescuing their names from oblivion. No biography teaches a more melancholy lesson than that of neglected genius; the least therefore we can do for such martyrs of science is to protect their memories by awarding them the honour that may be found fairly due to them.

Though we do not apply these general animadversions in their full extent to Professor Renwick, of America, we feel that the occasion calls upon us to express, without reserve, our pain and sorrow that he should employ talents, which are considerable, in endeavouring to set up Fulton as the inventor of Steam Navigation, in the face of evidence so conclusive to the contrary. The Professor would have it appear, that the patent of Jonathan Hulls, in 1736, for his steam-boat, and his pamphlet, in 1737, wherein he, first of all mankind, clearly directs public attention to the "usefulness" of steam navigation, merit only oblivion. He then, still more unworthily, seeks to throw ridicule upon the positive exhibition of its practicability in Scotland, which he calls "a complete failure!" in order, as rightly observed by Mr. Russell, (p. 237) "to place his countryman (Fulton) on a pedestal where an American might have the satisfaction of doing homage, for one of his greatest national blessings, to an American, rather than a Briton." To Mr. Russell's work itself we must refer our readers for the able manner in which our author has not less ably met than convincingly refuted this attack upon his countrymen. Mr. Russell has at length established, more fully than had yet been done, that to Great Britain

alone the honour of the origin, and first practical application, of steam to navigation is undoubtedly due.

Our readers, who have heard Fulton's claims so often vaunted, must not suppose that its exhibition in Scotland consisted of one or two imperfect experiments that left the question one of doubtful utility, which was subsequently more satisfactorily verified by him. It was, on the contrary, a real and practical application, which he saw at work in a steam-boat there, that induced him to persevere in America through many failures, satisfied that what he had seen done in Scotland might be done in his own country. Yet, even with the benefit of drawings and notes of Symington's steam-boat and engine, and proportions of power to tonnage, it was only after one or two failures, (in comparison to Symington's boat,) that Fulton could approach an equal performance; the usual attendant on the man who merely copies, and does not originate. Symington too invented the engine that propelled his boat, gave its proportions, and had it made under his own inspection. Fulton was dependent upon the talent of another for his moving power, which was made at an *English* manufactory; he was saved all trouble or responsibility of construction; its right performance was guaranteed by the reputation of Mr. Watt; to him therefore, he was equally indebted for his machinery, as he was to Mr. Symington for the method of its application. We do not call this inventive genius; at least on this side of the Atlantic.

There is much error abroad respecting Fulton's talents, and his claims on the gratitude of mankind; and though we have not sought to say severe things to disturb the memory of a man to whom America owes so much, it is only when it is forced upon us, by people making him ridiculous, by giving him attributes that he did not possess, that it is proper to remove his statue from the high pedestal it has been placed on, and lift it down to its proper position. He has been all but deified in America, as the benefactor, not of that country merely, but of the whole human race. Judges, statesmen, and philosophers, have vied with each other, with all the extravagance and enthusiasm of an unsound discrimination, to enoble his memory, and to insist that the world at large should do so too.

Now truth compels us to declare that, looking at the dishonest manner in which he sought to rob Symington, and arrogate to himself the invention of steam navigation, there is nothing in the character of the man, or in his claims to be considered the benefactor of mankind, to prevent us expressing considerable contempt for both. We form our opinion from a highly favourable source,—his most enthusiastic admirer, Mr. Cadwallader Colden, who has written a pretty thick volume of his Life and Inventions; and as the book is rather scarce in this country, we shall make free use of it to give our readers a fair estimate of Mr. Fulton.

We find him a mercenary adventurer, going about to the different Courts of Europe to sell his infernal torpedoes to the best bidder, with the most philosophical indifference to right and wrong. Taking a more comprehensive, certainly a more original, view of the matter than mankind generally, he seems to have been quite careless of such common principles of action. All he cared for was to try his "prepared carcasses." "Without feeling," says his biographer, "a partiality or enmity to either of the belligerents, he was desirous of engaging one of the nations at war, to give him the opportunity of trying the efficacy of his inventions;" which were "to blow whole ships' companies into the air, and not leave a man alive to tell the dreadful catastrophe!" "He was quite indifferent," continues Mr. Cadwallader Colden, "as to the temporary advantage it might give one over the other. He believed the result would be the permanent happiness of all!" The originality of his ideas are here on a par with his humanity; but fortunately for "whole ships' companies," the absurdity of his inventions prevented their flight "into the air," for "the permanent happiness of all!" His biographer takes care, however, to tell us of Fulton's bitter hatred to the mother country, (a hatred which, we fear, has unhappily increased in his countrymen, and continues undiminished to this day,) and that his object was to destroy her maritime superiority. Yet we find that when France ridiculed his projects, he, notwithstanding his hatred, as readily offered his services for British gold, to blow up his former friends, as he was first paid by France to blow up our sailors. Found in this country a mere schemer, as he had been

in France, he relinquishes his torpedoes, and, hearing of Symington's success in steam navigation, goes to Scotland, and is generously permitted to take notes of the steam-boat, which is put in motion, with all the liberality of genius, expressly for his observation. He then sneaks in disguise to Boulton and Watt, for one of their engines, returns to America, and carefully concealing the origin of steam navigation, permits himself, with all the marks of an inferior grade of mind, to receive the honours of the invention! He had not that noble independence of spirit, which is inseparable from genius of a high order; he was not manful enough to own his obligations to the man he had robbed, and with whom he promised to share the advantages. His new philosophy of wholesale murder "for the happiness of all," his cool indifference as to the victims of his torpedoes, and his breach of moral obligation to Symington, only leave to the patriotic mind, or independent inquirer, the doubt as to which surpasses the other in folly and baseness.

With all the boasted "success," too, and "sound views of theoretic principles and predictions" now claimed for him by Professor Renwick, it is not a little remarkable that Fulton himself displayed so little sagacious foresight; so little of that penetration into the far future, which is one of the characteristics of genius, as to think but little of steam navigation. In a letter to his friend, Joel Barlow, dated in August, 1807, he says, speaking of the success of his steam navigation,—"I will not admit that it is *half so important* as the torpedo system of attack and defence." Now, when we see what steam navigation has done, and is doing, and that the torpedo system has sunk into the neglect and contempt it deserves; that it was to the last of the two inventions he devoted most of his time, and which he considered the most important; we can only conclude that his was not a genius of that calibre that could have invented steam navigation. His originality was, in truth, ridiculous, and his usefulness borrowed. There is, also, something excessively amusing in the fact of a man spending years of thought and labour in preparing instruments of destruction which must depend for their efficiency upon the impossibility of their application! BRITISH MEN-OF-WAR, forsooth, were to be blown up whilst the sailors were napping! Those sublime powers, whose thunders ever swept the ocean,—Argus-eyed preservers of our inviolate isle,—were to slumber on their shadows, to permit torpedoes to be securely and properly fastened under their bottoms, "to give him the opportunity of trying the efficacy of his inventions;" as little boys are assured they can catch sparrows by salting their tails. It has always appeared to us, from the above passage of his letter to Joel Barlow, that Fulton constantly felt, what he well knew, that he was *not* the inventor of steam navigation. It was by far the most astonishing application the world had then seen, (for we must look at it as it was then considered, not as it has since been made familiar to us,) and, such is the constitution of the human mind, that he would have clung, with at least as much tenacity, to the more surprising invention of the two, as the more wonderful child of his intellect (especially when its practicability had been established) as he did to his absurd torpedo system.

We would not, however, be unjust to Fulton's memory, though he has, and all after him have, sought so dishonestly to deprive our countryman of all claim to the origin of steam navigation. The Americans may be properly proud of him. He struggled nobly through many and great difficulties to force the invention upon America, against the fears, prejudices, and ridicule of his countrymen, long before they were prepared, as a nation, to receive a benefit so vast. Yet his perseverance, compared with that of Symington, who had still more to contend against, was of a very inferior description It was the positive conviction of experience that bore him up. Symington had no instruction; he had to establish from his own sole and innate resources, a power which was then totally unknown in the experience of mankind, the wonder of the ignorant, and the ridicule of the learned: his perseverance was the true instinct of genius. But for Fulton's efforts in America, his name would never have been preserved from the mass. Though his fame is, therefore, indisputably based upon Symington's, we do not say that through him alone he claims to be remembered in his own country; inasmuch as whoever introduces a valuable invention, through the difficulties encountered by Fulton, deserves well of his nation. But beyond his own country, his name is

scarcely entitled to record. Fulton will go down to posterity as the benefactor of America; Symington, of the world. The former was a man of considerable, though not of powerful talents; of good general capacity, but of no genius. Symington was of undoubted genius; who saw clearly the end to be attained, and was able to originate and vary his means to obtain it. Though toil is as well the attendant of genius as of talent, yet will genius do more in a day than talent in a month. It is the lightning's flash that pierces the darkest concealment, and lays bare the hidden system of nature; talent is the common daylight by which every thing may be perfected, but little or nothing discovered. Symington hewed his own way through the difficulties of science, and by the force of his own powerful mind turned nature into a new channel and controlled her powers. Fulton followed in the broad and beaten path prepared for him: he did but continue the stream by extending its bed. When Columbus showed how to make the egg stand on end, he gave a fine example of the distinction, with a practical rebuke to the depreciators of genius, by pointing out how soon that ceases to be a difficulty where the way is once discovered.

We have been led, unconsciously, at greater length than we intended, into the question of Symington and Fulton's claims. In thus awarding to Symington, alone, the distinguished honour of the invention of a power, of equal importance to the discovery of a new world, and of equal sublimity in its character, we have anticipated claims of much nicer appreciation; and if we have arrived at a decision somewhat different to that of Mr. Russell, we hope to show that it is on sufficient authority; upon positive evidence, as far as it goes, and upon probability where—now that Miller, Taylor, and Symington are in their graves, and amidst the adverse statements they have left—probability alone remains. First hear Mr. Russell, to whom we give every credit for the pains he has taken to come at the truth of the evidence. He says,—

"It has been very usual to attribute the invention of the modern art of steam navigation to Patrick Miller, Esq., of Dalswinton, in Dumfries-shire, in Scotland. Two competitors have contested his claim. We shall soon see that to no one of the three can the palm be awarded. The creation of the steam-ship appears to have been an achievement too gigantic for any single man. It was produced by one of those happy combinations in which individuals are but tools, working out each his part in a great system, of the whole of which no single one may have comprehended all the workings. The individuals who have contested the title of inventors of steam navigation, are PATRICK MILLER, JAMES TAYLOR, WILLIAM SYMINGTON.

"After long and patient examination into the claims of these parties—after having gone over the papers, published and unpublished, of the parties advocating the claims of each candidate—after having examined all the individuals whose personal testimony to the facts of the case we have been able to obtain—after weighing the circumstances in which the evidence has been obtained, and the testimony given, we have to present to our readers, as the result of the whole, this conclusion, that the art of steam navigation was the joint invention of those three—Patrick Miller, James Taylor, and William Symington; that to their efforts the world owes its present advantages."

Mr. Russell then gives at length the particulars upon which he considers that "Miller, Symington, and Taylor are the three equal stars of the constellation to which the homage of posterity is to be paid." It would occupy too much of our space, and be, perhaps, not quite fair to the publisher, were we to extract at length Mr. Russell's interesting account of the rise and progress of steam navigation in Scotland. We must be content with observing that the experiments (and there were only two in which Miller, Symington, and Taylor were jointly concerned, Symington having subsequently continued them alone,) took place, the first on the lake at Dalswinton, Mr. Miller's residence, in October, 1788, with a boat of about four tons, and one-horse power; and the second on the 26th of December, 1789, at Lock 16, on the Forth and Clyde Canal, with a vessel about 30 tons, and 12-horse power. Though these experiments were eminently successful, and established, beyond doubt, the practicability of steam navigation, no further ones were made by these parties jointly; the engine was taken out of the vessel, and that was restored to its former use as a pleasure boat. The infant power was then allowed to sleep until 1801, when it was, under the sole direction of Symington, again called from its obscurity, and

in his hands alone displayed that vigour that gave assurance to the world of the stupendous giant it would one day become. Miller and Taylor, therefore, ceased to have any connexion, in name or otherwise, with experiments in steam navigation, after 1789. It now remains for us to determine, from the statements of Mr. Russell, whether to the three jointly, Miller, Taylor, and Symington, or to which singly, the honour of the invention of steam navigation is fairly due. The substance of our author's inquiries is this :—

Mr. Patrick Miller had been engaged in experiments to propel vessels by manual labour by a crank turning a paddle wheel. In 1787, he published an account of his experiments at some length ; and, amidst much matter useless to the world, there is this solitary gem :—"I have also reason to believe that the power of the steam engine may be applied to work the wheels, so as to give them a quicker motion ; and, consequently to increase that of the ship. In the course of this summer, I intend to make the experiment ; and the result, if favourable, shall be communicated to the public."

Mr. Russell then gives a narrative, drawn up by Mr. James Taylor himself, of his connexion with steam navigation, "the authenticity and genuineness of which appears to us (Mr. Russell observes) beyond a doubt." Mr. Taylor says that, "in 1785, he went to live in Mr. Miller's family, as tutor to his sons ; that he attended him repeatedly in his experiments in 1786 ; and that, in the spring of 1787, he found the inefficiency of manual labour, on account of its severity, in propelling the vessels by hand ; and he then told Mr. Miller, "that unless he could apply to them a more commanding power than that of men, he was afraid the invention would be of little use." He answered, "I am of the same opinion ; I want a power more extensively useful, which I have not as yet been able to attain. Now that you understand the subject, will you lend me the aid of your head, and see if you can suggest any plan to accomplish my purpose." "It became the daily subject of our conversation, and after beating over the whole system of mechanics, I said, 'Mr. Miller, I can suggest no power equal to the steam-engine, or so applicable to your purpose.'" Mr. Miller appears, however, to have been sceptical for some weeks, but Mr. Taylor says, "the more he (Taylor) thought of the business, the more he became satisfied of the propriety of applying the steam-engine ;" that "Mr. Miller at last said, 'Mr. Taylor, you are right. If we cannot accomplish the whole, (its application to general navigation, as also suggested, says Taylor, by himself,) we may a part ; but will you show me how you will connect the engine with my wheels, and I will think of it?'"

Mr. Russell observes, that this conversation took place in 1787 ; and that, subsequently, Mr. Miller wrote his treatise on ships, from which our former extract is taken.

As Mr. Miller nowhere claims the originality of the idea, nor the method of verifying it, but only casually and slightly alludes to it, amidst other matters he thought of every importance, and to give an account of which, (not of steam navigation,) he expressly wrote his book ; and as Taylor, too, positively states that Mr. Miller not only did not originate the idea, but asked him, previous to the publication of his work, "to show him how to connect the engine with his wheels," we may fairly dispose of Mr. Miller as having no claim whatever to be considered one of the "joint inventors" of steam navigation. He was no more the joint inventor of this power, simply because the experiments were made at his expense, than was Mr. Boulton of the steam-engine, because he spent between 40 and 50,000*l*. in bringing Mr. Watt's improvements to perfection. Both were munificent patrons of the infant power, the one on land, the other on the water ; though Miller is entitled to a higher regard, since he sought no benefit from its adoption. To his memory we cheerfully accord this rare praise :—he was a patriot in the best sense of the term, desirous of his country's glory and advancement, uninfluenced by personal advantages ; he was a liberal patron of science, and deserves to be held in respect by all good men ; he was also an ingenious experimentalist in propelling boats, on which he spent large sums, though, previous to his introduction to Symington, they were all useless. Much, therefore, as we esteem the memory of Mr.

Miller, we must, upon Mr. Russell's own facts, sincerely, but strongly, protest against our author classing him in future as one entitled to participate in the honour of the invention of steam navigation. We were indeed astonished that, on no better evidence than this, he could award to Miller any share in it.

As regards Taylor's claim, we will now show that, though Miller's title to be considered one of the joint inventors is so small as to cast no shadow of its substance, Taylor's is still less; if it be possible, indeed, to make out of nothing less than nothing.

We have seen that Taylor positively asserts that it was he who communicated the idea to Miller. In this he is as positively contradicted by Symington, who declares that, in 1787, Miller called at Mr. Meason's, (Symington's patron,) to see the working model of a steam-carriage, invented by Symington in 1781; that a conversation ensued respecting Miller's experiments, (before referred to,) and that he, Symington, then "stated his opinion to Mr. Miller, that a steam-engine might be constructed which would propel a vessel, by communicating a rotatory motion to the paddles by the alternate action of two ratchet wheels, in the same manner as in the model of the steam-carriage then before them;" but that "Mr. Miller said he considered such a thing impracticable."

"The description given of the model, and the manner in which it was intended to apply the power of steam, seemed to convince Mr. Miller of the practicability of the project; and he observed, that if Mr. Symington thought he could construct a steam-engine, and work it with safety on board of a vessel, an experiment should be made, on a small scale, as soon as he (Mr. Symington) could possibly attend to it; *and it was explicitly understood, that the plan and construction of the engine, the mode of producing rotatory motion, and the means to be adopted for guarding against danger, were to be left entirely to Mr. Symington. Soon after this conversation, by Mr. Miller's desire he proceeded to construct a small engine,* ON A SIMILAR PRINCIPLE TO ONE FOR WHICH HE HAD PREVIOUSLY PROCURED A PATENT."* Mr. Bowie then gives an account, similar to Mr. Russell's, of the success of the first and subsequent experiments. In opposition, however, to that part of the above statement, of Symington being the first to suggest the idea to Miller, we find the following letter from Symington to Taylor, of the date of

"August 20, 1787.

"I must make some remarks upon your summer's inventions, which, if once made to perform what their author gives them out for, will undoubtedly be one of the greatest wonders hitherto presented to the world, besides its being of considerable emolument to the projector. Great success to you, although overturning my schemes; [but take care we do not come upon your back, and run away with them by some improvement. Your brother John gives a kind of credit to your report, which, for some reasons, I did not discourage. I must conclude, &c. &c.]

(Signed) "WM. SYMINGTON."

The part within brackets, taken from the 58th number of *Chambers's Edinburgh Journal*, of the 9th of March, 1833, we have added to Mr. Russell's extract. The letter is there brought forward to substantiate Taylor's claims to the sole invention of steam navigation; and we certainly never read any statement more evidently formed upon ex-parte information, or more clearly drawn up by a partial hand. The purpose of the author is defeated by his zeal; it is the advocacy of a rabid partisan, not of a truth-seeking compiler. The editors of that journal have unworthily lent their talents, and a large circulation of a very useful and instructive publication, to distribute erroneous information, unmindful of the duty they owe to themselves, to the public, or to the neglected genius of the dead. We will not comment upon the bad taste and want of feeling in which the writer attacks the memory of poor Symington. Being neither called for, nor necessary, nor true, it only reflects great discredit upon the party.

Mr. W. Symington explains his father's letter thus:—Taylor had written to him an account of some inventions he thought of, for propelling vessels by the reaction of water from a pump to be worked by hand; a worthless method that has since been fruitlessly

* Bowie's Brief Narrative and Affidavits of the late Mr. Symington's Claims. Sherwood and Co., 1833. This, it appears, was drawn up from Mr. Symington's own statements, by Mr. Bowie, his son-in-law.

patented by three or four individuals. Symington's "scheme" which it was to overturn, if successful, was steam navigation, on which his thoughts had been then occupied. Mr. Bowie, in the Narrative alluded to, says, "The editors of *Chambers's Journal* pledged themselves to prove their assertions, and boasted of their possessing much documentary evidence; but although requested to redeem their pledge, they have, for nearly a month, thought fit to maintain an undignified silence—a sullen or pitiful resource." And Mr. Bowie "pledges himself to substantiate any statement contained in his Narrative." The letter from Symington proves nothing against his claims; on the contrary, it gives us the impression of a mind laughing to itself at the absurdity of Taylor's inventions ("Your brother John gives a *kind of credit* to your report, which *for some reasons I did not discourage*"); also a consciousness of superiority, that, whatever Taylor might invent, he, Symington, could "run away with by some improvement." No one can reasonably infer that it was steam navigation Symington was sceptical about, since it was he alone who had invented, at that time, all the means for its accomplishment. Mr. Russell's own statement, indeed, completely refutes such a supposition, for he observes, (p. 189,) that when Mr. Miller asked Symington "as to the practicability of adapting a similar engine to that which turned his carriage wheels to the purpose of turning the paddle-wheels of Mr. Miller's boat," "Mr. Symington *appears to have seen no difficulty; nor was it likely he should do so*, for his locomotive engine appears, on an examination of its plan, to have required but little change to adapt it to this application. Mr. Symington seems *at once to have expressed his* CONFIDENCE *in its applicability*." Now, looking to the superior genius of Symington, as an engineer, (sufficiently shown by his excellent steam-engines, and other inventions, as far exceeding any thing that has proceeded from Taylor, who has left absolutely nothing behind to prove that he possessed any talent whatever in that way,)—looking also to the fact that Symington was an engineer by profession, and had already invented, as admitted in the above extract by Mr. Russell, the means of applying steam to navigation, we do not think that Symington would have spoken so lightly of this invention, in his letter to Taylor, had "Taylor written him a full account of it," as assumed by Mr. Russell at p. 188. We think, too, that had it been really steam navigation that Taylor wrote about, the same source, from which the above conversation was obtained, would have preserved some reference, by Symington, to Taylor's communication, and to a change of opinion on further considering it; for Mr. Russell says, no sooner was it mentioned to Symington, than he not only "saw no difficulty," but that it "*was not likely he* should do so," and he "*at once expressed his confidence in its applicability.*" Yet Taylor, as well as Miller, was present at this conversation! Though Mr. Russell is far above any object in the omission, we think he would have done better had he given the concluding part of Symington's letter, which we have added in brackets, because that part certainly ridicules the inventions referred to, whatever they were; and upon the above evidence, that Symington then possessed the power of steam navigation in his own hands, the result of his own simple and beautiful invention, we do not think our readers will infer that he would have so spoken of it. Upon no rules of evidence or induction are we entitled to assume it. There is no proof whatever that Taylor wrote to him about steam navigation, or that this letter referred to it. It was first produced to bolster up Taylor's claims in 1833, when Symington was dead, and but for a casual conversation with his son would have left nothing to explain it; so that, after a lapse of forty-six years, one solitary letter, never previously known to be in existence, is brought to light, which might refer to a hundred ridiculous inventions, with far more probability, (from so good a judge as Symington,) than to steam navigation. Such a document would be scouted, even as presumptive evidence, in any court of law or equity in the world. "Probability is the guide of life," we are told by one of the closest reasoners of his time (Bishop Butler). Look, then, at the two men, Taylor and Symington, as they have come down to us

in their works, (though where to find Taylor's works, for the comparison, has hitherto eluded our search,) and say on which side is the probability that the letter did or did not refer to steam navigation?

It is certain that Symington had some "schemes" for propelling vessels on water. Neither Taylor nor his advocates have ever explained what these "schemes" were, though they have *assumed* that they were *not* connected with steam navigation, but that Taylor's inventions alluded to in Symington's letter *were*. Thus a new logic has sprung up; improbability is assumed for Taylor, and probability denied to Symington. Positive evidence is wanting on both sides, and that which, next to it, carries the greatest weight in all mundane affairs; that which we employ for the solution of many difficult questions of the past and future, is twisted from its right application, and most unphilosophically bestowed in favour of the party least entitled to it. As to Symington's letter in 1821 (*Chambers's Journal*, No. 58) agreeing to give Taylor a share of the invention, it was, as stated "in terms of our former agreement when making experiments of sailing by the steam engine." Now nothing is more likely than that, as Symington was not the mere mechanic called in by, or employed and paid by Miller, to make the machinery, (for Symington never received a farthing for his services) he was then willing to give Taylor, an old schoolfellow too, a share of the invention, for the introduction to Miller as the means of verifying it. Such terms are common enough. What then do we gather from probability, when we pursue it still further? *Chambers's Journal* admits the talents of Symington at a very early period, when they say he had "invented a new construction of the steam-engine, by throwing off the air pump,* being at the time in Edinburgh *for his education*." It is proved beyond question, by the drawing in Mr. Bowie's pamphlet, that Symington's steam-engine, attached to his model carriage, invented in 1784, but not made till 1786, was admirably adapted to produce a continuous and easy rotatory motion. And Mr. Russell observes, too, that "Mr. Symington had at an early period directed his attention to the improvement of the steam-engine; and his principal aim seems to have been the construction of a compact and portable steam-engine, adapted to the production of a continuous revolving motion. In this attempt he was *perfectly successful*." Now here was the first grand difficulty overcome; the puzzle of Smeaton, Watt, and all other engineers was solved: and though the crank has superseded Symington's ratchet plan, as well as Watt's sun and planet motion, and every other substitute, (and very many they were,) yet Symington had at once removed the great obstacle,—the connexion of the wheels with the engine, so anxiously asked of Taylor by Miller. He had only to apply the same motion to turn a wheel in the water, as he had used to turn a wheel on land, and both must go with a speed proportioned to the power. We certainly think, then, that, independent of Symington's positive assurance, the probability is, that the mind which had originated the application, and had overcome the mechanical difficulty of applying the steam-engine to propel on land,—that had invented an engine for the express purpose, an engine which "was perfectly successful," was very likely to be the mind that did first suggest to Miller its application to propulsion on water. When, therefore, Mr. Russell gives the authority of his name to the "authenticity and genuineness" of Taylor's narrative, we think he goes far beyond what the evidence justifies. We doubt not Mr. Russell has taken sufficient pains to satisfy himself of the "genuineness" of the document, but he produces no evidence at all of its "authenticity."* But it is not our desire to give credence to one statement over the other, now that Taylor and Symington are both dead; our readers must form their own opinion upon what evidence

* This is an error, as appears by the drawing of the original engine, which appeared in our Magazine, Vol. xviii. 1832: and shows that Taylor really knew nothing about the steam-engine to have made so egregious a blunder.

* As some of our industrious readers may not have had an opportunity of going into the niceties of such distinctions, we give the following explanation of Bishop Butler as the most celebrated:—"A book may be genuine without being authentic; and a book may be authentic without being genuine. A genuine book, is that which was written by the person whose name it bears, as the author of it. An authentic book, is that which relates matters of fact as they really happened."—Butler's Two Apologies, p. 183.

there is; weigh it well with the probabilities, and decide as they preponderate. For ourselves, we deem it of no consequence whatever to the real merits of the case, and to Symington's claim to be considered the inventor, even if the partisans of Taylor decide that the idea first originated with him; for neither he nor his wildest advocates claim the invention, or arrangement, of the means, or any part of the machinery, or proportions, that would alone ensure success, and upon the correct adaptation of which its practicability entirely depended.

Admitting then, but only for the sake of argument, that Taylor suggested the idea, why should he be considered the inventor in preference to Jonathan Hulls? He went far beyond Taylor, for he actually obtained a patent for his steam-boat, dated the 21st of December, 1736; and in 1737, published a pamphlet with a full description of it, and the means of working the paddle-wheels; accompanied, too, with an engraving of the steam-boat having a ship in tow. This pamphlet was publicly sold in shops, and Taylor may have seen a copy of it; but, whether he did or not, he was quite incapable of applying the idea, if it were his own. If a mere idea, then, is to be considered as giving a claim to the honour of an invention, Taylor is certainly not entitled to that of steam navigation, when a patent had been taken out for it 51 years before, and a pamphlet published, fully describing its application. For full extracts from it we refer our readers to Mr. Russell's book.

Taylor, then, having neither given the capital, nor ingenuity, to Symington, to carry out the thought, and being superseded by Hulls in the idea, if original, has, in our opinion, far less claim than Miller, (who, at any rate, advanced the money for the experiments,) to be considered as one of the "joint inventors" of steam navigation; nor is he one to whom the world is in any degree indebted. We cannot, therefore, but express our regret that for a work of reference, like the Encyclopædia Britannica, destined to hold a lasting place in our libraries, Mr. Russell has not discriminated *his own evidence*, with a sounder judgment, and, in a matter of so much importance, disposed more justly the claims of Miller, Taylor, and Symington.

The real claim has always appeared to us where no one has ever thought of investigating it, between Jonathan Hulls and William Symington; between these two individuals and no others. One was the first who, ever in this world, really and truly suggested the idea, and fairly brought that idea before the public: the other was the first who ever really and truly embodied that idea, though we believe Symington's steam-carriage suggested to him steam navigation also. Symington it was who first, of all mankind, showed it practically to the world; who alone persevered in it in 1801—2, and in 3, on a much larger scale; from whose success Fulton took it to America; from whom it rose into importance, and from whom its rise and progress are clearly to be traced. All "ideas," "suggestions," or other nibblings previous to its verification came to nothing, and are lost in the haze and uncertainty of the past. Symington, alone, had the originality and boldness to grasp the giant, whom he conquered, and made subservient to the purposes of man. Miller and Taylor's claims to the joint *invention* are, in truth, so weak, that nothing but the injudicious flattery of friends could have induced them to vamp up any thing so futile, and to leave statements which have deceived others. Both, perfectly incapable of inventing the means, see the very thing invented by another, get him to put it into a boat, leave every arrangement to him,* find it answers admirably, and then separately claim and dispute the priority of an invention which belongs to neither! It is not the man who throws out a loose hint that this and that thing *may* be done, or who talks about it, but he who *does* it—who brings it before our eyes—who says to the world, "there it is, examine its action; now we'll light the fire, and you shall see it shall do what I say it can do." It is all the difference between the real and the ideal. The first creates a new power, the other only fancies it. The former has the highest order of talent; he overcomes all the difficulties of an unattempted science; of that which is new to man; which human intellect never yet attempted; where there is no experience for his guide; no

* Miller writes thus:—"To the Carron Company, 6th June, 1789.—Gentlemen, the bearer, Mr. William Symington, is employed by me to erect a steam-engine for a double vessel, which *he proposes* to have made at Carron. I have, therefore, to beg that you will order the engine to be made *according to his directions*," &c.—See p. 193, Mr. Russell's work.

books—nothing but the resources of his own mind from which to draw instruction or encouragement. The probable he renders practicable, the dangerous safe; he explores his way in an unknown country, and others follow in the path he has cleared by his own unaided efforts. Now although we place Jonathan Hull's claim to the invention of steam navigation, immeasurably above that of either Miller or Taylor, yet, as his plan was never carried into effect, and as no steam-boat ever moved on British waters until Symington took the science in hand, TO SYMINGTON ALONE WE AWARD THE HONOUR OF BEING THE SOLE INVENTOR OF STEAM NAVIGATION. Neither do we feel the least doubt that sooner or later *posterity will confirm that award.*

Between the claims of the mere projector, and him who, by the slow course of toil and labour, discovers and adapts means to ends, and makes an invention practically useful to man, which before was doubtful, it is not, we think, difficult to decide to whom the gratitude of the world is due. Before Columbus discovered America, Seneca predicted it, and the North-men visited it in the tenth century.* Yet though thus foretold, and though thus touched and made certain, to Columbus is due the honour of the discovery. He directed public attention to another hemisphere; by his exertions and genius it was rendered available; and from him flowed that stream of enterprise to the new country, which, like steam navigation from Symington, has since continued to enlarge. If mankind were not so to determine, the claims on the gratitude of posterity would be so various, and uncertain, (for the idea of every invention we ever read of has been disputed,) that none would be given to any. Mr. Watt's separate condenser is disputed; and Newcomen gave him the beam, piston, and elastic packing, cylinder vacuum to work the engine by, condensation by injection, valves, and buckets; much more indeed than Watt added to it.† Yet Watt made it that machine which, superior to the paradoxical lever of Archimedes, has in reality moved the world. To him are statues properly raised, and he receives the admiration and gratitude of the whole civilized earth. If we were to enumerate all the analogous cases that are familiar to us, we should far exceed our limits. We have given two of the most remarkable instances, and we ask for Symington, the gratitude of posterity as the first who practically directed attention to steam navigation—who gave to it that certainty which is now doing so much for mankind—and from whom its incalculable benefits have been derived.

We make no apology for the length to which we have gone in our endeavours to rescue Symington's memory from a partial oblivion, and to refute the claims of those, who, without any of his talent, would deprive him of his just honours. We proceed shortly to show his remarkable judgment in his first attempts in steam navigation.

Mr. Russell (at p. 191) observes, in giving an account of the second experiment (1789), that "*the vessel was propelled with perfect success at the rate of nearly seven miles an hour, being about as great a velocity as it has been found possible to obtain by steam boats on canals, even at the present day.*" Our author lays a proper stress upon this fact in his italics. The judicious proportions of power to tonnage, (yet unsettled among our first engineers and men of science) showed, at that early period, combinations of a very high order. Seldom indeed, if ever, do such early experiments so completely establish the object in view. In Mr. Russell's chapter on "The Theory and Practice of Modern Steam Navigation," he observes:—

"To construct a perfect steam-vessel, it is necessary, first, to make a perfect ship; secondly, to construct a perfect steam-engine and boilers of a very complete description; thirdly, to apply a propelling apparatus of the most appropriate description; and, finally, to combine the whole of those in a well-proportioned whole. Now to construct a perfect ship is of itself a problem of the highest order, requiring a combination of the most profound resources of analysis, with the highest practical sagacity; a problem on which the reasoning of the mathematician, and the tact of the

* See "The discovery of America by the Northmen in the Tenth Century." By J. T. Smith. It appears quite authentic, that five centuries before Columbus set his foot on America, it had been visited frequently by these Northmen.

† M. Arago has erroneously attributed inventions to Mr. Watt which belong to Savery and Newcomen. See Hugo Reid's pamphlet on the mistakes in Arago's Eloge.

artist, have long been engaged, with few examples of complete success. To construct a sufficient, effective, powerful, durable, and safe engine and boilers, for marine purposes, is a problem more easy," (though it was not in 1788 and 1801, when far less was known of the construction of an engine and boilers of this kind than the art of ship building,) "yet one in which has been encountered continual failure. Then the means of propelling the vessel over the element on which it floats, give rise to questions in the resistance of fluids, which all the resources of hydrodynamic science in the hands of the ablest mechanical philosophers of the last century have failed to resolve. Then, last of all, the combination of all of these together, in the best possible way to bring about the precise effect desired, is a problem still more arduous; and all the skill of the analyst, the geometer, the mechanical philosopher, the naval architect, the engineer, mechanic, and the sailor, if combined in a single individual, or concentrated on a single object, are not more than sufficient to the arduous task of directing the wealth, enterprise, and resources of this country, in the attempt to render available to her own prosperity, and the interests of the human race, this most admirable of all her creations."

Nothing we could say of Mr. Symington's genius could go beyond this tacit admission of it; for it shows how admirably must have been united in him these qualities, to have produced, fifty-two years ago, results, in a *second* experiment, equal to what are obtained in the present day.

We have before observed that after this time Miller and Taylor ceased to have any concern in Steam Navigation. Why was this? Because they had nothing to do with the invention. It is but reasonable to conclude that any individual of that period, wishing to take up the new power, would apply for the assistance of the one who was generally considered the inventor. Symington's reputation had no doubt spread, for in 1801, after an interval of twelve years, Thomas Lord Dundas requested his assistance. His Lordship did not apply to either Miller or Taylor, yet we are sure, if, at this time any one were to establish the practicability of electro-magnetism, and render it evidently available as a moving power, we should not only consider him the inventor to all intents and purposes notwithstanding all previous attempts, but should apply to him as the most efficient to superintend a similar machine. Yet were we to claim the invention, because we paid or employed the inventor, we should be as justly ridiculed now, as we ridicule the claims of others on the same ground. Had not Symington, then, been the real inventor, we do not suppose Lord Dundas would have applied to him in preference to the true inventor. He considered him, no doubt, the inventor, and on that account alone employed him. Mr. Symington planned and superintended the building of the vessel and the construction of the engine without any interference, the cost of which, with the experiments, was about £7,000, so that Lord Dundas must have placed considerable confidence in his capacity and judgment. The vessel was a tug, named the *Charlotte Dundas*, in honour of his Lordship's daughter, was 80 tons burthen, worked at a speed exceeding six miles an hour on the Forth and Clyde Canal, and was the one from which Fulton derived his information in July, 1801, as before detailed in the extract in our No. 936. This boat proved, on a still larger scale than before, the certainty of Steam Navigation; but owing to the supposed injuries to the banks of the canal it was laid up. Fulton was, however, making a rare harvest in America with Symington's invention, and it was not until 1812 that a steam boat again moved on British waters. This was the *Comet*, built by Bell, but not until three steamers were running, with the pride of independence, against the powerful currents of American rivers. For so long a period was one of our most valuable inventions allowed to lie dormant in the land of its origin.

We cannot refrain here from noticing what the American claimants to the invention of Steam Navigation may not thank us for dragging from its obscurity. We have met, among our researches, the following, in the Transactions of the American Philosophical Society, vol. vi. p. 96. It had been referred to a Committee of Inquiry in 1803, to report on the practicability of Steam Navigation. Mr. B. H. Latrobe read the result in a report, in which he says:—

"A sort of *mania* began to prevail, which indeed has not yet entirely subsided, for impelling boats by steam engines. Dr. Franklin proposed to force forward the boat by the

immediate action of the steam upon the water."

At this very time, when Steam Navigation was thus ridiculed by the Americans, it had been established, as we have seen, long before by Symington. As regards some experiments in 1783 by Fitch, on the Delaware, and by Rumsey, also an American, on the Thames, which some more zealous than the rest for American glory have brought forward, they are beneath notice: for it appears that their only claim to originality was their impracticability.

After Bell's *Comet* in 1812, the progress of Steam Navigation, though very slow, was progressive. It was not until 1818 that sea voyages were performed by steam, being first established in that year by Mr. David Napier. From this period its increase being a matter of undisputed history, does not require further notice from us here. Having now established, as we think, Mr. Symington's claim to the sole honour of the invention of Steam Navigation, we cannot let the opportunity pass without saying a few words on the deplorable neglect he experienced.

It was from no imperfection of character in Symington that he formed one among the many victims of genius who have the misfortune to live before their time. Perhaps some of our readers imagine, in the simplicity of their natures, that the steam-boat of this unfortunate man of genius could not have been successful, or the men of science of his day would have encouraged its introduction. Do they know so little of human nature as to suppose that even at this time an individual has only to show, by actual experiment, that an invention is really a good thing, to have it readily patronized? We have but to call to mind a few analogous truths from the history of science in other departments, to show that Symington only experienced the prejudice and perversity common to all ages. The illustrious Harvey was ridiculed and injured in his profession by his discovery of the circulation of the blood. The beautiful Lady Mary Montague, who practised on her own children the first "engrafting" or inoculation for the small pox, which she learnt in Turkey, was hooted in the streets as an unnatural mother, and the ministers of religion thundered their anathemas from the pulpit that "it came from the hands of the devil, and was of infernal invention." Dr. Wagstaffe, the most learned physician of his day, joined in the public execration, and condemned it. The Royal Academy in France pronounced it in 1715 "murderous, criminal, and magical." Dr. Jenner, who by the introduction of vaccination became the saviour of millions of human beings, was for a long time injured to a great extent in pocket and reputation! The opposition, indeed, to *his* discovery was so rancorous as to be scarcely credible, when we read of it now. The use of bark and antimony was prohibited by the incorporated body of French physicians. Watt could only introduce his steam-engines by giving them for nothing, and contenting himself with a third of the saving in fuel. Though mines in Cornwall were all but ruined, whilst others, using his engines, were recovering from a load of debt, still were they introduced with the greatest difficulty, and but for the Act of Parliament renewing his patent for twenty-five years, Boulton and Watt would probably have been bankrupts. Sir Joseph Banks in England, and the Philosophical Society in America, ridiculed Steam Navigation and called it "a mania." Fulton, in his own glowing description of his successful experiments communicated to Judge Story says:—

"The boat continued to move on—all were still incredulous—none seemed willing to trust the evidence of their own senses. We left the fair city of New York, we passed through the romantic and ever-varying scenery of the highlands; we descried the clustering houses of Albany; *we reached its shores; and then, even then, when all seemed achieved, I was the victim of disappointment. Imagination superseded the influence of fact. It was then doubted if it could be done again, or, if done, it was doubted if it could be made of any great value.*"*

In later times:—"I was considered mad," says Mr. G. Stephenson, "when I spoke of a speed of twenty miles an hour by railway." "It is far from my wish," says Mr. N. Wood, in his published opinion of locomotives, to the Directors of the Stockton and Darlington Railway:—

"To promulgate to the world that the

* Panegyric pronounced on Fulton, by Judge Story at the Mechanics' Institution at Boston.

*ridiculous* expectations, or rather *professions*, of the *enthusiastic speculatist*, will be realized, and that we shall see engines travelling at the rate of twelve, sixteen, eighteen, or twenty miles an hour. Nothing could do more harm towards their adoption of general improvement, *than the promulgation of such nonsense.*"

The well-considered opinion of men of no inconsiderable talent, of the impossibility of steamers plying across the Atlantic, is too recent to be forgotten.* And to bring down this mass of bigotry and prejudice to a still later period, such writers as those of the Athenæum have dogmatically opposed all *inquiry* into the facts of Mesmerism, because they could not account for them. In saying this we in no degree pass an opinion of its truth, but simply reprobate such disgraceful and lamentable displays of narrow-mindedness in journalists of so much talent. To attempt to stifle investigation into any science, and particularly into one that offers for inquiry facts for its support that, as far as they go, seem indisputable, is a mode of working upon the public mind so unphilosophical, so opposed to that progress of inquiry which is continually bringing new truths to light, that it deserves always to be exposed, to warn the public against receiving advice that would turn mankind again into bigots and persecutors. Nature is not yet exhausted of its millions of mysteries, all resolvable, doubtless, to unity. Let us, then, adopt in their discovery, as the maxim of the philosophic mind, Sir John Herschell's beautiful definition of the character of the true philosopher,—"Hope all things not impossible, and believe all things not unreasonable."

We have here shown some of the fearful barriers that are ever opposed to genius. Yet there is an ardour of pursuit in the robust mind that feels the inward promptings too vigorous to be repressed, that imparts a bounding and continuous impulse sufficient to surmount all difficulties. There is so much power in truth, such inherent virtue in it, that no good thing ever yet failed to make its way, and inventors have at least the consolation that no invention worth surviving can ever be lost to the world through the prejudice and opposition of mankind. Only let the thing be good, and we defy its oblivion: sooner or later it must prevail: it is only a question of time.

In our first extracts, we showed that though Livingstone was assisted by Mr. Brunel, now Sir M. I. Brunel, he could effect nothing with steam navigation. Dr. Franklin could do nothing with it. The Marquis de Joufroy, in France, failed there. Earl Stanhope, in 1795, was scarcely more successful. Yet Symington did succeed from the very first: he was as successful in 1789 as any one has been since, under the same circumstances. Let us, then, accord to Symington his fair praise, when we find that neither of such men as Dr. Franklin, nor Sir M. I. Brunel, both minds of considerable capacity, the last deservedly eminent too in mechanical and constructive science, could solve the difficulty. When the rich and celebrated fail, it is by so much the more arduous for the poor artisan, for one unknown to fame and fortune, to convince the world of success;—it will not believe him. So was it with the poor Symington: he had no wealth, and then no name. And yet he lived in an age as little steeped in prejudice as any; an age of fearful and wonderful moral and physical revolution; an age more distinguished by remarkable men than any previous era of the world. In every branch of human exertion—mechanics, constructive science, invention, discovery, history, enterprise, astronomy, medicine, anatomy, chemistry, the fine arts, sculpture, painting, music, engraving, moral philosophy, romance, poetry, the stage, the senate, the bar, the army and navy,—the great men and great authors that diffused the brilliant rays of their genius over the world in the latter half of the 18th century, and beginning of the present, (natives of the different countries of Europe, though chiefly of Great Britain,) will never, perhaps, be again equalled for the magnitude and usefulness of their discoveries, or the enjoyment they have left for countless generations. Let our readers call up the great names that appeared upon the stage in that time, and they will own that there were giants indeed on the earth in those days. Where now are their equals? We almost deem, when we look at the dwarfs in intellect of the present day, for the comparison, that Nature, tired of the efforts she had made, had ceased from her labours, and produced a lull in the intellect of nations. And yet it is a melancholy reflection, that of the illustrious departed, if we except Watt, those who are

* This opinion has been generally attributed to Dr. Lardner; but we have been assured he did not say so. What he said at the Meeting of the British Association at Bristol, in 1836, was maliciously or erroneously reported; and thence went the round.

in the present, and who will be in a future age, most held in remembrance for their imperishable works, those whose genius was the most rare and unquestionable, those to whom, for the refinement of the intellect and the enjoyment of life, mankind owe the most, should, though so different their lives, share an end equally deplorable. Lord Byron lived his short time unhappy, and died in the prime of life, more from a blighted spirit, than any other cause. Walter Scott had his share of the fatal gift of genius; he lived happily, but his sun set in clouds and darkness, and he long lingered, a melancholy wreck of a mighty mind. Symington, too, died in poverty and neglect, after suffering much and severe distress. To be "illustrious and unhappy" would seem almost synonymous; for if we consider the men of genius in any age and country, misery seems to be to them the rule—and the greater the genius, the loftier the degree—happiness the exception.

The Poet, with a wide sweep of observation, has well delineated their fate, in the following lines of equal bitterness and truth:—

> "If ye would gather laurels to your name,
> Be illustrious, and live unhappy:
> Such is the solitary path to fame,
> Over a worn-out mind, from peace to flee,
> The slave of genius, not its lord to be.
> Thy very virtues to thy fate impel;
> Earth hath no haven of repose for thee:
> Crush the wild throb ere yet it break its shell,
> And give thy heart's peace over to an earthly hell!"

Yet we know that the aspirings of genius are, for some wise purpose, irrepressible. Though the hieroglyphics with which nature has recorded her mysteries are destined to be unravelled only by those who must become martyrs in the discovery, individuals are never wanting for the sacrifice. The fate of others may warn, but it never deters. It is, indeed, a mysterious dispensation, that those who interpret the designs of Divine Providence, in the discovery of its secrets, should, like Moses on Mount Pisgah, be permitted only to see. Seldom do they partake in the blessings they confer; they sow the seed, but the next generation reap the harvest. They lift the veil, they penetrate, they disclose; but the present flows through their hands without pleasure; they toil, and die early, or if old age comes, it comes without provision for its wants. Seeing this, we may perhaps hope that the insight into the rewards that await the inventors of the useful arts in the Elysium of Virgil was no fiction of the heathen poet, but a portion of that inspiration which is confined to no age. But, since the heirs of genius do partake in this life of the misery entailed with the inheritance, let us who draw our benefits from their misfortunes, appease their manes, by doing justice to their memories: let us go farther when we can, and assist the families of those whose fathers' poverty has bequeathed them to our care.

Look first at what Symington has done for us. Steam navigation has covered the whole habitable globe with its cloudy presence, alike the wonder of the savage, and the admiration of civilized man. Rapid rivers were, previous to its introduction, wholly unnavigable, and the solitudes they led to—choicest prairies for the habitation of the human race,—inaccessible; the currents are now stemmed, and their waters bear on their bosom the perfection of human art, with the deepest philosophy of mind, to call into existence a teeming population on spots that never before echoed but to the whoop of the savage. Deserts and solitudes, which, a few years back, were inhabited but by a few scattered and miserable men, now resound with the busy hum of civilization. Towns and cities have sprung up on the morass. The links of one vast chain of civilization, are with unexampled and wonderful rapidity, spreading to the most remote places, that scarcely a lake or river in any part of the globe is seen, without that wondrous power that subdues all things to its dominion. It renders powerless the winds and waves, and tides, in their wildest fury, and most rapid sweep. It has repaired the convulsions of nature, by reuniting great continents and their empires in more kindly relations. The friend of the poor man, the companion of the rich—the richest and poorest alike participate in the comforts and luxuries it places within their reach. The perishable commodities of distant countries it brings to our tables. The vast resources, indeed, that it has opened to our grasp, are beyond all calculation. The benefactor of mankind, it exhibits the most wonderful dominion of mind over matter, that the world has witnessed since its creation, bidding fair, in its further application, to do more for the happiness and rapid ad-

vancement of the human race, than even printing, for it must shorten those atrocious wars which for thousands of years have kept back, incalculably, the civilization of the world. It is the moral and physical lever for the regeneration of mankind; the modern Prometheus, whose ethereal fire pervades all things, forming man, and subduing nature, with a more ready and plastic hand than before. "Gentlemen," said the Earl of Liverpool, at the memorable meeting at Freemasons' Tavern, on the 18th of June, 1824, for erecting a monument to the late Mr. Watt, "Gentlemen, we have now no delay in our communications with any part of the world. Whatever it may be necessary to communicate, and to whatever quarter, be the winds, friendly, or be they contrary, the power of the steam-engine overcomes all difficulties. Gentlemen, *I have known in time of war, when the fate of a campaign, and possibly the fate of a war might depend upon getting a fleet out of port, contrary winds have prevailed for months, and the whole objects of government have been thereby defeated. Such difficulties can no longer exist.*" But who did, in truth, effect this great change in the condition of the earth? Who first showed how to get a fleet out of port, and hath done this vast service to his country? Not Mr. Watt, assuredly. The Earl of Liverpool had been misinformed; he should have applied his praise to poor Symington; but Symington had no powerful friends, no Boulton for a patron, that could do anything—a name known to the world, for intellect and great wealth, long before Mr. Watt's was heard of. Great as was Mr. Watt, and *we* are not of those who would take an atom from a fame that has spread itself to the ends of the earth, a fame never more justly won, or more meekly borne; yet, be it remembered, we owe nothing, of all that steam navigation has done, to him. He did not invent it; he never tried a single experiment in it; he never lent his great mind to its investigation; we have sought in vain for a single expression of the great man, to show even that he seriously considered it practicable. In all that has been so eagerly hunted up of Mr. Watt, by M. Arago and others, (supplied chiefly by the present Mr. James Watt,) in all that his friends and admirers have given to the world as his inventions, (and more has been attributed to Mr. Watt than he ever claimed,) yet nowhere do we find, among the numerous subjects to which he directed his most versatile and comprehensive mind, any consideration of, much less any attempt at, steam navigation. Nor is it dependent even upon his engine. The high pressure engine, though not adapted, perhaps, to delicate manufactures to the extent of Mr. Watt's condensing engine, is equally applicable to all the purposes of steam navigation. It has, indeed, nearly superseded Mr. Watt's engine in America, and though he included high pressure steam in the 4th article of his specification of 1769, it is well ascertained that it was fully understood long before.

But beyond all this; had Watt never lived, Symington's engine was perfectly sufficient for steam navigation. He alone invented it, alone applied it; he alone proved it. He obtained, as we have seen, a speed equal to anything that has since been done under the same circumstances. Inventions of the magnitude of steam navigation are generally the unlicked infants of centuries; here it sprang at once, in its full vigour, and giant proportions, from the brain of Symington. Where shall we find its parallel—so successful, so complete, so early? There was no failure, no want in the skill and efficiency of his power, or in its application. Who, then, will be confident enough, after this, to deny to Symington all the honour of the invention of steam navigation? And are there any so mean, who, now that the science is familiar to them, will deny to the inventor all credit for the difficulties overcome in giving it to the world? We hope not one; for genius would, indeed, have a terrible ordeal to go through, if, after struggling to the death to introduce what the world will not believe, when it ceases to be wonderful by familiarity, mankind should refuse their gratitude and reward because it then seems to them so easy to have been done. To such we have nothing to say; those who love to dissect genius till they leave it a skeleton, we leave to all the enjoyment of depreciation, and the aversion of good men. We will but remind them that Mr. Watt's grand discovery was a square box and a bit of pipe, the mere removal of the place of condensation—two feet; all the rest of his engine, except the covering to the top, was the application of the inventions of others. Yet what has not his engine done? Lord Brougham

designated Mr. Watt the inventor of the steam-engine. Shall we, then, not call Symington the inventor of steam navigation!

There are so many coincidences of inventions in the arts and sciences, and in literature, that even had Miller or Taylor thought of steam navigation at the same time as Symington, (though there can be little doubt it was he who communicated it to Taylor and Miller,) yet, as M. Arago justly observes, "persons, whose whole life has been devoted to speculative labours, are not aware how great is the distance between a scheme, apparently the best concerted, and its realization." We have already seen that, if their own version of the business is correct, they were quite incapable of realizing it, and called in Symington, who did. Had his talents been drawn forth by such a patron as Boulton — if he had had 40,000*l.* or 50,000*l.* at his command to protect and improve his invention, when Miller would no longer continue them—what improvements might he not have made—how many might he not have anticipated, which it has taken about half a century to produce! What a fortune would he not have left to his family! Though we must take the following with all the allowance due to the modesty of a great mind, yet Mr. Watt was not insensible how much he owed to Mr. Boulton. He says, [p. 74, Arago's Eloge,] "To his friendly encouragement, to his partiality for scientific improvement, and his ready application of them to the processes of art; to his intimate knowledge of business and manufactures, and to his extended views and liberal spirit of enterprise, must, in a great measure, be ascribed whatever success may have attended my exertions." What Symington did was under the pressure of want. He could not nurse his genius; he was obliged to bend it to the every-day pursuits of a different occupation, to support the claims of a rising family, who could not stay for the future. And yet this man was allowed to die in poverty, his claims were not even allowed to be investigated, and his drawings and affidavits that he left at the Treasury to substantiate them, were lost, or refused to be given up! His Majesty George the Fourth gave him 150*l.* from his privy purse; *that* is all he ever received from a government for which his genius had done so much.*

* Bowie's Narrative, p. 24.

Sure we are his claims could never have been properly advocated or understood, or a country that gave 5,000 to Compton for his mule-jenny; 10,000*l.* to Cartwright for the power-loom; 30,000*l.* to Harrison for his chronometer; 30,000*l.* to Jenner for his vaccination; 50,000*l.* to Palmer for his mail-coach system; and, more recently, 7,000*l.* to Messrs. Foudrinier, for their paper experiments, would never have refused honourable compensation to Symington. And yet, will our readers believe, *can* they believe, that Taylor's widow has succeeded in getting a pension of 50*l.* a-year for the fictitious claims of her husband! We will not say *how* it has been got.

Had Symington's claims been any where previously adequately investigated, we should not have entered so fully into them. Perhaps this may have arisen from the notoriety of the fact, for, as to the mere fact, we find, in the following works of authority, the positive admission of the invention belonging to him. The Quarterly Review for March, 1830, p. 380; Oxford Encyclopædia; Galloway on the Steam-Engine; Burrowe's Modern Encyclopædia; Report of the proceedings of the Managers of the Forth and Clyde Canal Company, with respect to Steam Navigation; Brewster's, Edinburgh Encyclopædia; Encyclopædia Londinensis; Capt. Basil Hall's Travels in North America, vol. ii. p. 387; Encyclopædia Metropolitana. In the supplement, too, to the Encyclopædia Britannica, his claim is fully acknowledged in these words: "It is indisputable that Mr. Symington was the *first person* who had the merit of successfully applying the power of the steam-engine to the propulsion of vessels. It is much to be regretted that there existed not enterprise enough, at that time in Scotland, to encourage the ingenious artisan to repeat his experiments on the Clyde. All the subsequent improvements, however, in steam navigation, *may be fairly traced to Mr. Symington's attempt;* and we cannot help thinking he has a *strong claim on the national gratitude.* He is still alive, and, we fear, not in the most flourishing circumstances. Should the State decline rewarding such meritorious services, the opulent proprietors of steam-boats might well evince their liberality and discernment, by bestowing on him some recompense."

In all this we perfectly agree; and

though the ill-used Symington himself is now beyond the reach of neglect or assistance, it is never too late to do justice to his memory, through his family. Worn out by much mental distress at the ingratitude and neglect he experienced, when thousands around him were reaping the reward of his labours, he died in poverty in London, on the 22nd of March, 1831. Selected by Providence for one of its highest designs, in the rapid amelioration of nations by means of his invention, he partook not of its benefits; yet, with the nobleness of mind that attends talent of a high order, though he felt, he did not murmur at his fate. His widow, we are informed, is still alive, and dependent on others for support. Two sons and two daughters also survive. We think, then, a national testimonial to the family is due from Great Britain, and that a public subscription should be solicited, as the worthiest method of evincing it. If the public still doubt that Mr. Symington was the author of steam navigation, we would suggest to his family to lay their affidavits and papers before three or four engineers, or gentlemen of reputation, and call upon Taylor's family to meet the investigation. For ourselves, we have no doubt of Symington's title; we have examined all the evidence brought forward by the several claimants, and we have decided with strict impartiality. We know not whether our suggestion will meet the approbation of his surviving relations; but as the family of some of the greatest names that will descend to posterity think it not beneath their dignity (and it never can be beneath individuals to accept a nation's gratitude, however shown) to receive the public expression of a country's sympathy with the misfortunes of their sires, we think Symington's family may worthily accept a similar token.* Our fine river is now turned into one of the noblest highways in the metropolis, by means of steam-boats, and thousands daily participate in the conveniences and health which this novel mode of transit has opened to them. Those who are indulgently enjoying this great luxury, as they read these observations, have only to revert to the tediousness and uncertainty of water communication a few years back, to be fully sensible of all they owe to Symington; and they will then scarcely fail to record their sympathy for the man who held on his appointed way in resignation, amidst penury, neglect, and ill health, to perfect for posterity this wonderful invention. Let them be assured, that, had he not so early established its practicability, the course of time had not given these facilities of intercourse to the present generation. As some noble river has its origin in one spring of greater magnitude than the rest, though smaller streams may swell its waters, so does steam navigation owe its chief existence to Symington, and through him are we indebted for the vast benefits we are now receiving from this source. When the public are fully satisfied of his claims, we do not think a nobleman or gentleman in the land can be found to refuse acknowledgment of the right of Symington's family to the nation's gratitude. Sure we are, that the poorest artisan will be glad to show his sympathy with misfortune, that he may feel the satisfaction that there exists within his breast that softest and tenderest of feelings. We would remind him that, as the ocean is but an accumulation of drops, so will his smallest contribution, like the minutest particle of dew, swell the stream of beneficence, and return again tenfold to its source. If every one who has benefited by the labours of Symington were but to contribute sixpence to the store, his family would become the richest commoners in the world. What is a mere trifle for each of many to give, would amount to an ample recompense for one family to receive.

In removing the laurels from the brows of pretenders, and placing them to the memory of Symington, we have been led to encroach on our usual variety of matter. We must therefore defer, for a concluding notice, some remarks on the more scientific portion of Mr. Russell's work.

* In England 10,000l., and in Ireland 6000l., were raised to compensate the improvidence of Sir Walter Scott. Is there not, then, benevolence enough to set Symington's family above want—a far higher and nobler object?

### GRAND DISCOVERY IN CHEMISTRY.

A discovery has been lately made, which is likely to extend widely the boundaries of chemical science. The views of the alchemists, with regard to the transmutation of metals, are now shown to be of possible realization. Chemists have ceased to draw any line of distinction between those bodies ordinarily termed metals, and other elementary substances—*i. e.* in proceeding through the list of elements, from oxygen to platinum, we cannot say where the metallic property commences. Now Dr. S. Brown, of Edinburgh, has given proof in a paper read before the Royal Society of that place, that the elementary body carbon can be converted into silicon, which last substance was, not long ago, considered metallic. Observe, this is not the decomposition of silicon, or rather the formation of it, from a new base, but the proof of the absolute convertibility of one elementary body into another, which we must still regard as simple. This grand discovery, second to none that has ever been made in science, and likely to prove of vast benefit in its results to the resources of the arts, is the work of a young man, who had however given proof of the greatest powers—*ex pede Herculem.* Like other great discoveries it has been preceded by such indicative facts as might gradually induce us to regard it as possible. We allude to the doctrines and facts of isomerism, which showed that some compound bodies, presenting on analysis the same chemical composition, might yet differ greatly in properties. In these cases it was conceived that the atoms might be differently arranged, or that the composition of the one body might be represented by doubling the atoms of the other, and so forth. Thus, if we have a body whose composition may be represented by *a b*, we may write it *b a*, or twice *a b*. Now, as our only reason for believing any body to be simple is, that we are unable to decompose it, it is quite possible that some of the bodies which we call simple might really be compound and isomeric. But to sum up the facts presented by Dr. Brown:—His late communication is purely of a practical character, the author having refrained from presenting what he conceives to be the *rationale* of the singular facts he has discovered, until further investigations of a similar kind shall have been executed by himself or others. The manner in which the author establishes the isomerism of carbon and silicon is very simple, and consists in giving a great many processes by which the former may be converted into the latter. These are contained in a series of five sections: the first treats of the production of silicon from free paracyanozen; the second, of the formation of mixed siliciurets of copper, iron and platinum, by the reaction of paracyanozen; the third, of the quantity of nitrogen separated from paracyanozen, when it is changed into nitrogen and silicon; the fourth describes processes for the preparation of transparent crystallised siliciuret of iron from the paracyanide of iron and the ferrocyanide of potassium; and the fifth gives easy processes for the extraction of silicic acid from ferrocyanide of potassium by the action of carb. potass. The last of these processes has been repeated in the laboratory of the Newcastle Medical School, and found to give the result described by Dr. Brown.—*The Mining Journal.*

### ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

*** *Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for the purpose.*

WILLIAM NEWTON, OF CHANCERY-LANE, CIVIL ENGINEER, *for improved machinery for clearing wheat and other grain or seeds from smut or other injurious matters.* Petty Bag Office, July 11, 1841.

Two cylinders are placed one within the other; the lower part of the outer cylinder is contracted in the form of a funnel, for a depth of three inches, and then terminates in an open bottom; its interior is cut into a series of ridges, which are vertical up to within eight inches of the top, when they slant off at an angle of 12°. From the periphery of the inner cylinder, which is moveable, a number of radial beaters extend in the direction of the ridges above noticed. The upper end of each beater is elongated, so as to form vanes, which occupy and revolve within the space between a flanch on the top of the outer cylinder and a cap-plate. The beaters are of thin metal, their edges standing about half an inch from the internal surface of the outer cylinder. The upper end of the shaft of the inner cylinder is supported by and turns upon a steel bolt, which, being hollow, allows oil to be poured through it into a receptacle in the top of the shaft.

The grain to be cleared being fed into the space between the cylinders, a rapid motion is communicated to the inner one, and the grain descending towards the lower part of the cylinders is acted upon by the beaters, which break and detach the smut-balls, white-caps, or any other injurious substances of a softer texture than the grain. The rapid motion of the vanes at the same time expels the air from the upper part of the machine,

creating a strong upward draft, which carries off all the light matters that have been separated from the grain, which by its superior weight gradually falls through the bottom of the apparatus, on to the floor.

The claim is, 1. To the mode of producing a strong upward current of air, by the contraction of the lower end of the outer or fixed cylinder, and the wings or vanes at the upper end of the revolving cylinder. 2. In combination with the foregoing, to the peculiar form and direction of the ridges made within the outer cylinder, and surrounding the inner cylinder with peculiar beaters, capable of throwing the grain against the ridges; such beaters consisting of flat radial strips of metal, which extend vertically along the lower portion of the cylinder, but are inclined towards the upper ends. 3. To the adaptation of the stationary bolt, or hollow gudgeon, as connected with the receptacle for containing oil in the manner described.

John Barwise, of Saint Martin's-lane, Chronometer Maker, and Alexander Bain, of Wigmore-street, Cavendish-square, Mechanist, *for improvements in the application of moving power to clocks and time-pieces.* Petty Bag Office, July 11, 1841.

This invention consists in a mode of communicating motion to clocks by means of electricity. For making and breaking alternately the electric connexion between the source of electricity and the electro-magnetic clocks the following arrangement is employed. To the back plate of the regulating clock an ivory ring is fixed, around which at given distances a number of metal studs are fastened flush with the front side of the ring, but projecting from the back of it for the attachment of wires connected with a corresponding number of clocks. The spindle of the escapement wheel is lengthened, and receives at its end a spring which presses on the ivory ring and metal studs. A positive wire from a galvanic battery is connected with the spring on the escapement spindle, and as soon as the movement of the pendulum brings the spring on to one of the studs the electric current passes to it and through a wire helix placed around a soft iron bar with which each clock of the series is provided, returning to the battery through the negative wire.

While under the influence of the electric current the soft iron bar is rendered magnetic and attracts a spring which is held in an upright position in front of it; by this means a catch-spring is made to pass over one tooth of the escapement-wheel, and to hold to it until the return stroke of the pendulum of the regulating clock brings its spring on the non-conducting surface of the ivory between the studs, when the soft iron is unmagnetised, and the upright spring, being set free, falls back upon the end of a regulating screw, which causes the catch-spring to move the escapement-wheel of the time-piece.

Each clock has a positive wire proceeding from the studded ivory ring of the regulating clock, but only one negative wire is used for all, one end of which being fixed to the last clock, it passes through all the other clocks of the series, and terminates in the negative pole of the battery.

The patentees state, in conclusion, that the various parts of the invention may be combined in various ways besides those described; the following is given as an important instance. Suppose the regulating clock to show true Greenwich time, the pendulum vibrating seconds, the conducting wires may extend to any distant station, and a clock at that distance, (say twenty miles,) would indicate Greenwich time. This clock having a source of electricity connected with it, and provided with a suitable apparatus, may transmit its movements to a second, and that in like manner to a third, and so on to any required distance, the clock at each station showing true Greenwich time. Each clock may, in like manner, regulate the movements of all other clocks in its immediate neighbourhood; and thus all the clocks in a large establishment, or throughout a town, or any number of towns, may be thus made to exhibit a perfect uniformity of time.

William King Westley, of Leeds, Flax Machinist, *for certain improvements in carding, combing, straightening, cleaning, and preparing for spinning hemp, flax, and other fibrous substances.*—Enrolment Office, July 14, 1841.

The first improvement relates to the screw gill, and consists in removing the pillow blocks from between the drawing rollers and the comb, and supporting the impelling screws or spirals by two pillow blocks, placed behind the barrel of each screw, or by one pillow block of sufficient length to answer the purpose of both bearings; or by placing the impelling screws in tubes having openings to receive the ends of the comb bars or fallers. By this means smaller drawing rollers may be used, and the shortest fibres operated upon. Another arrangement consists in placing the cams or tappets from the spirals on separate shafts lying alongside of and in gear with the spirals; so that the latter will only propel the fallers, which will be raised and lowered by the side rods. In this arrangement two spirals between each head will be sufficient. The second improvements consists in the use of *papier machée* for the construction of cylinders for carding engines; the pulp is cast in moulds of the

form required, or it is formed into flat bars, which are bolted to iron drum rims, and afterwards turned true. The same material is also applied in a similar manner to the manufacture of stocks for heckles, combs, and gills.

The third improvement is a new bend, and bend-pen for carding engines, made of a hollow cast-iron segment of a sphere, boxed up below by a rib of iron. The shaft of the small cylinder to be raised or lowered, is supported by a standard, on the stem of which is cut a right-handed screw, and received into a socket tapped on the inside with a right-handed, and on the outside with a left-handed screw, by turning of which the standard is moved up and down.

The fourth improvement consists of a chain or flexible rack, the links of which have teeth on their outside for taking into spur-wheels on the shafts of spindles, cylinders, bobbins, &c., for communicating motion thereto.

The fifth improvement consists of a method of heckling, combing, &c., of fibrous substances, by means of holders connected together in pairs by screws, by tightening of which a fixed pressure is obtained, so as to hold the strick firmly between them; one end of each roller is square, by means of which the holder may be turned round. A number of rollers are placed in a frame, and are made to travel on the upper part of the machine above the combs, so as to expose the stricks to their action. The strick, or parcel of fibrous substance to be acted upon, is placed between the holders, so that they shall grasp it as much on one side of the centre of the strick as may be equal to a quarter of the circumference of the holder. The fixed pressure is then applied, and the longest ends of the stricks heckled or combed; the holder frame is then taken to a stuffing machine, the screws slackened, and the holders turned half round, thereby drawing in or shortening the longest and heckled portion, and lengthening the shortest or unheckled portion, which in its turn projects from the holder, and is exposed to the action of the combs.

The sixth improvement consists in the application to circular heckling machines, of a mode of shifting the holders from one series of combs to another. Any number of circular heckling machines being disposed in a row, or united in one frame, back and front, the holders, after travelling over one series of combs, descend upon a rail, crossed by an endless chain and rail segments, which shift the holders across to the next series of combs. The holders are lowered to, and taken up from the rail by arms or pins projecting from barrels or bosses running loose upon a fixed shaft extending along the machines; the barrels being geared into the main wheels of this shaft.

The claim is, 1. To the improvements in the apparatus or machine known by the name of the screw-gill, as herein described, and the application of the same together with its improvements, as well as the screw-gill in common use, as a feeding mechanism to carding engines, instead of the cylinders now used, called feeders or feeding rollers. 2. To the application and use of the material known by the name of "papier machée," for the construction of cylinders for carding engines, whether hollow or solid, and stocks for heckles, combs, and gills. 3. To the invention of an improved bend and bend-pin for the carding engine. 4. To the construction of toothed or gear-chains, for communicating motion to the cylinders, spindles, bobbins, and other parts of machinery, for preparing for spinning fibrous substances, being in fact, a flexible rack. 5. To the method of heckling, combing, or brushing fibrous substances, as described, which is mainly effected by means of holders, capable of partial or complete rotation; which holders may be made of iron, of iron combined with felt, or of any other fit material, or combination of materials of any suitable length, and in their transverse section of a round, square, polygonal, or any other figure. 6. To the application of the mode of shifting the holders from series to series of combs, as described, to the eccentric circular heckling machine in common use.

Caleb Bedells, of Leicester, Manufacturer; Christopher Nickels, of York Road, Lambeth, Gentleman; and Archibald Turner, of Leicester, Foreman to the first named, *for improvements in the manufacture of braids and plats.*—Enrolment Office, July 19, 1841.

The first part of the invention relates to an improved construction of braiding machines, and consists in the application of extra pipes thereto, which are used to introduce extra threads for ornamenting the fabric. When fringes are made to the braided fabrics, the extra threads act as tie-threads to keep them from unravelling. The heads in which the extra pipes are used have extra grooves formed in them, and the patentees prefer their axes to be hollow, as this arrangement enables the machine to produce common braids, or braids with longitudinal threads, and also fringed braids, with the mandrils previously patented by the above Christopher Nickels.*

For the purpose of introducing the extra threads, the form of the tappets or con-

* Vide abstract of specification, *Mech. Mag.* vol. xxxiii. p. 607.

ducters is slightly altered, and four of them furnished with springs, having a tendency to hold them in one direction, so as to guide the pipes; two of the other tappets are regulated in their movements by cams fixed on vertical axes, each being driven by tooth-gearing on one of the axes of the heads. These cams act upon projecting fingers on the axes of the tappets, so as to guide the extra pipes correctly.

The second part of the invention consists of a mode of causing the pipes of a circular braiding or platting machine to pass out of the circle into extra heads, the object of which is to obtain flat double fabrics, for receiving tapes or threads of India-rubber, &c. If the pipes are to pass out on one side of the circle only, one of the heads on that side is made $\frac{1}{8}$ larger than the rest, and has an extra groove cut in it; if the pipes are to pass out on both sides of the circle, one head on each side is altered as above.

The claim is, 1. To the mode of constructing braiding machines, whereby extra pipes are used to introduce extra threads, such threads passing from selvage to selvage of the fabrics produced by the machinery. 2. To the mode of causing the pipes of a circular braiding or platting machine to pass out of the circle into extra heads, as required.

FREDERICK STEINER, OF HYNDBURN COTTAGE, LANCASTER, TURKEY-RED DYER, *for Improvements in looms, for weaving and cutting asunder double piled cloths, and a machine for winding wefts to be used therein.* (A communication.)—Enrolment Office, July 19, 1841.

These improvements consist firstly, in forming the tappet of the loom of a series of revolving wheels, each of which being moved along its axis by suitable levers, acts in succession upon treadles, whereby the ground is woven. Also in the use of an eccentric plate for raising or depressing the pile, so as to be woven into each cloth alternately.

Secondly, in applying a vibratory roller, so as to keep the yarn that is to form the pile in a state of uniform tension.

Thirdly, in an improved gauge for keeping the two cloths, which are united by one common pile, at a uniform distance from each other, and by that means regulating the quantity of pile yarn taken up by the blow of the reed.

Fourthly, in moveable shuttle-boxes, which are raised, in order that the shuttle may pass through the shed of the upper piece of cloth, and lowered, in order that the same shuttle may pass through the shed of the lower cloth.

Fifthly, in an improved circular knife and traversing apparatus, by which it is made to cut asunder the pile uniting the two cloths when traversing in one direction; but, while returning, the knife is sharpened by two hones, which, during the time the knife is cutting, are oiled and cleaned by two pieces of wash-leather attached to a forked arm.

Sixthly, in a machine for winding weft on a fixed conical bobbin, by means of a hollow revolving and traversing spindle and fly, which wind the weft conically round the bobbin, decreasing their speed as the diameter of the cone diminishes, and increasing their speed as its diameter increases; whereby the weft nearest the centre or axis of the bobbin is more solid than when wound in the usual manner.

JAMES SMITH, OF DEANSTONE WORKS, KILMADOCK, PERTH, COTTON-SPINNER, *for certain improvements in the preparing, spinning, and weaving of cotton, silk, wool, and other fibrous substances, and in measuring and folding woven fabrics; or in the machines and instruments for these purposes.*—Enrolment Office, July 19, 1841.

The first part of this invention consists of an improved method of mixing cotton, wool, or waste. A number of bales of wool are opened and placed along both sides of the mixing room, in which there is an opening machine fed by means of a long table, provided with a feeding creeper, from 20 to 30 feet long. A workman takes the cotton from the bales, beginning at one end of the series and passing along to the other, taking from five to six pounds from each bale, and throwing it upon the creeper, over which it is spread by another person.

Under the machine and feeding table, a receiving box is placed of the same width and 20 feet long; this box runs upon wheels, and passes from end to end of the opening machine, receiving the cotton from it in alternate layers. When the box is filled, it is taken to a scutching and lapping machine, which, instead of an ordinary feeding table, has a creeper attached to it, rising obliquely from near the floor to the height of the feeding rollers. A circular revolving rake, 3 or 4 feet in diameter, is placed across the bottom of the creepers, its rows of teeth passing between the ribs of a concentric grating; in the bottom of the receiving box there is a succession of creepers, which being put in motion, constantly and uniformly press the mass of cotton up to the ribs; this causes the rake to draw from the end of the mass a continuous flow of cotton, which being thrown upon the oblique creeper, passes in a regular sheet to the feeding rollers of the scutching machine, thereby furnishing a thorough mixture of the various bales or packages from which the cotton was taken.

The second part of this invention consists in a self-topping process applied to the common carding engine, whereby the tops are

lifted, cleaned, and replaced by the working of the machine.

The third part relates to a mode of spinning finished threads direct from the carding engine: for this purpose the cotton, &c. is taken from the rings of the doffers by the usual comb and passed along in little troughs and through filters which compress it into a suitable form and guide it into the spinning rollers, through which it passes to the twisting spindles, where it is wound upon the spinning bobbin. This mode of spinning from the carding engine is intended for the heavier numbers: but for spinning yarn finer than number 8 or 10, a set of carding cylinders are employed in lieu of the drawing rollers generally used for spinning from rovings, by mules, or other spinning machines, and the material being taken directly from the doffer of these cylinders is spun into thread, either on the mule or throstle principle.

The fourth part consists of a metallic strickle extending across the width of the carding engine, whereby the outline of the wire or teeth of the cards is kept straight and uniform.

The fifth part consists in the application of a self-acting scavenger roller to the upper surfaces of the covering boards of the mule carriages, and giving it a traversing motion, whereby the flue or other waste falling on the board of the carriage is cleanly taken up. The roller is formed of tin or other tubing covered with a piece of clearer cloth.

The sixth part relates to the preparation of warps for weaving, which are wound upon the beams in a wet state and submitted to the action of steam in a steam-chest, until the whole mass is of the same temperature as the steam; the steam is then shut off, and the moist vapour extracted by an air-pump, any remaining moisture being driven off by placing the beam in a drying stove.

The seventh part consists of the following improvements connected with the shuttle: a hose-socket fitted to receive the point of the pirn cope when being thrust upon the skewer, is fastened to the framing of the loom, whereby the workman is able to employ part of the weight of his body in forcing the cope into its place, while at the same time the point of the cope being compressed in the hose-socket is consolidated and prevented from unravelling or coming off too loosely at the first. A corrugated skewer spring is used, the corrugation sloping gently from the point of the skewer inwards, but sloping quickly outwards; by this means the cope is permitted to slip easily to its place, but is prevented from being forced off by the sudden movement and stopping of the shuttle. The eyes of the shuttle are placed in an oblique position for the purpose of equalizing the tension of the thread as it flows from the cope.

The eighth part relates to improvements in stopping the loom when the weft-thread is not thrown in.

The ninth part consists in the employment of needles with the eyes at the top for receiving the warp-threads in Jacquard weaving; also in the introduction of a travelling endless creeper under the working barrel, to assist in passing the cards from its discharging to its receiving side; and also in placing a reed at the back of the needles for keeping the threads in their places among the needles.

Finally, the patentee observes, that his improved measuring and folding machine is so similar to that already patented by Mr. M'Kinley, of Manchester, (and described at page 412 of our last volume,) that he could not specify it without infringing thereon.

John Melville, of Upper Harley-street, Esquire, *for improvements in propelling vessels.*—Enrolment Office, July 21, 1841.

The main shaft of the engines extends through both sides of the vessel, terminating in two cranks, placed opposite to each other. A paddle is placed on each side of the vessel, from which a stem rises; near the lower end of the stem there is a journal, in which the crank-pin works, while its upper extremity is jointed to a vibrating radius rod. On motion being given to the crank shaft, the floats describe an elliptical curve in the water, entering and leaving it nearly perpendicularly.

The claim is, 1. To the propelling of vessels by the employment of two paddles, arranged and guided as described, one being placed on each side of the vessel, and driven by cranks attached to the ends of the engine shaft. 2. To the use of two shafts connected together, and each carrying two paddles as described; such paddles being caused to enter the water in regular succession, by the propelling cranks upon one shaft standing at right angles, to the propelling cranks on the other shaft, so as to produce a continuous action in propelling the vessel. 3. The arrangements by which the paddle stems are guided, viz., either by causing them to slide over and vibrate about a fixed point, or by carrying a point on the stems that moves in a fixed groove or slot. Although this patent was only sealed in January last, the invention was exhibited and publicly used four months previously, at which time we noticed its similarity to one previously patented by Mr. Stevens. Vide vol. xxxiii. page 400.

Angier March Perkins, of Great Coram-street, Engineer, *for improvements in apparatus for heating by the circula-*

*tion of hot water, and for the construction of pipes or tubes for such and other purposes.* Enrolment Office, July 21, 1841.

The first part of these improvements relates to the apparatus for which a patent was obtained by Mr. Perkins in 1831, and consists in returning the water to the furnace to be re-heated, after warming each room of a series, by which means every room receives an equal degree of heat.

The second improvement is, in the construction of cast-iron pipes for the above and other purposes, and consists in casting the pipes with right and left handed screws on their ends; so that when the ends of two pipes are brought together, and inserted in a coupling-piece, having a right and left handed screw formed within it, by turning the coupling piece round, the two pipes are drawn together, and a tight joint made. A ring of pasteboard, or other suitable packing, is inserted between the pipes.

In order to allow of the longitudinal contraction or expansion of the pipes, (which is not afforded by the foregoing arrangement,) the end of one of the pipes is made with a female screwed socket; the end of the other pipe is plain, and is inserted into the socket, leaving a space between, in which a ring of pasteboard or other suitable packing is placed; next to this is an iron ring, and then a short pipe with a male screw fitting that in the socket; by screwing up this pipe, a joint is formed admitting of the required expansion or contraction.

The claim is, 1. To the mode described of constructing apparatus for circulating hot water, by causing the water to be repeatedly heated in its course of passing through one circulation. 2. To the mode of manufacturing the joints of cast-iron pipes for circulating hot water, and for other purposes, by casting such pipes with left and right hand screws, and combining therewith screw couplings with left and right hand female screws, and suitable packing as described. 3. To the mode of forming the joint herein described, by casting the parts in iron.

Isham Baggs, of Cheltenham, Gentleman, *for improvements in printing.* Enrolment Office, July 23, 1841.

These improvements are two-fold, and consist, firstly, in applying the chemical powers of electricity to printing in colours; and secondly, in a mode of employing tests in printing.

The mode of printing is as follows:—pieces of metal of $\frac{1}{18}$ of an inch thick are cut out in the form to be delineated from plates of different metals. Thus, if it were desired to print a yellow flower with green leaves and a brown stalk, the flower would be cut out in iron, the leaves in copper, and the stalk in silver; these pieces are soldered upon a copper plate, and their surface ground to a true plane. The required lines are then formed in the leaves and flowers with a graver in the usual way; it is then ready for printing. Paper, in order to be printed from this plate, is wetted with a solution of carbonate of soda, and placed on the negative pole of a galvanic battery with the plate upon it; on bringing the positive wire in contact with the plate, the alkali of the carbonate passes to the negative pole, and the acid to the positive pole, where, acting upon the different metals, it produces a copy of the design in its proper colours. To print by means of frictional electricity, the design is formed by cementing a number of very small platinum wires on to a glass plate, which is laid on paper moistened with any suitable solution. If iodide of potassium and starch is used, on passing a charge of electricity through it, a purple impression of the design will be produced; but other metals and solutions may be used.

The mode of employing tests in printing is as follows:—"It frequently happens," says the patentee, "that I am limited to certain colours by the application of particular tests; for example, iodide of potassium produces a beautiful yellow with lead; but, if it is desired to form a blue at the same time, there is no metal that will give one with this re-agent." The plan to be adopted therefore, is to make a mixture of different tests, with regard to the play of affinities likely to be called into action. The proto-salts of iron form a beautiful blue with sesquiferro-cyanuret of potassium, but are not at all affected by iodide of potassium; if, therefore, these two latter re-agents are mixed and applied, there will result the required blue and yellow.

The claim is, 1. To the mode of printing in one or more colours by the application of electricity, however obtained. 2. To the mode of employing tests described.

Richard Jenkyn, of Hayle, Cornwall, Machinist, *for certain improvements in valves for hydraulic machines.*—Enrolment Office, July 26, 1841.

These improvements consist in the employment of two or more valves, in addition to the single valve and seating commonly used, so that every valve below the uppermost serves as a seating to the one above it. These valves are hung by joints one above the other, the uppermost being the smallest.

The claim is, To the use of the additional valves constructed as described, so that they may serve also as seats, being hung in the ordinary manner by joints, but without any cross-bars, guides, or spills in the valves or seatings to obstruct the entrance of the

water; also the mode of combining a series of valves.

CHARLES SCHAFHAUTEL, M.D. OF SWANSEA; EDWARD OLIVER MANBY, OF PARLIAMENT-STREET, CIVIL ENGINEER; AND JOHN MANBY, OF THE LATTER PLACE, CIVIL ENGINEER, *for improvements in the construction of puddling, balling, and other sorts of reverberatory furnaces, for the purpose of enabling anthracite, stone coal, or culm, to be used therein as fuel.*—Enrolment Office, July 30, 1841.

Instead of the usual single fire-place, at the end of the reverberatory furnace opposite the chimney, in these improved furnaces the fire-place or grate surrounds the hearth on which the ores, &c. are placed, except in front of the door, and the passage leading to the chimney which are directly opposite to each other. By this mode of construction, the ores or other substances are acted upon by the flames on all sides, and therefore anthracite or other short-flamed coals can be advantageously used therein.

The claim is to the surrounding of the metals, ores, or other substances, in the puddling, balling, or other reverberatory furnace, constructed on the plan or principles of the furnace herein described, the dimensions and details of which may be varied according to circumstances, as is the case with the reverberatory furnaces now in use. And the patentees claim the above, as a mode of employing in reverberatory furnaces anthracite or stone coal, and culm, or other short-flamed fuels, as well as bituminous coal, or other long-flamed fuels heretofore in use.

DOMINIC FRICK ALBERT, LL.D. OF CADISHEAD, NEAR MANCHESTER, MANUFACTURING CHEMIST, *for an improved or new combination of materials and processes in the manufacture of fuel.*—Enrolment Office, August 1, 1841.

This fuel is composed of 5 parts of bituminous schist, ground, $2\frac{1}{2}$ parts of dry aluminous clay, mixed with $\frac{1}{10}$th part of mineral oil, 5 parts small coal ground, and $2\frac{1}{2}$ parts of vegetable tar, evaporated with $2\frac{1}{2}$ parts of mineral tar. The two latter substances are heated to a proper consistency, and the other ingredients previously mixed together are added and worked up into a homogeneous paste, which is then run into a hole in the ground to cool and form a cake.

The claim is to the new combination of materials and processes herein described for the manufacture of fuel.

HENRY PAPE, OF GREAT PORTLAND-STREET, PIANO-FORTE MANUFACTURER, *for improvements in castors.* Enrolment Office, August 1, 1841.

These improvements consist merely in the application of two wheels or rollers to each castor, instead of the usual single wheel, a contrivance already included in a recent patent bearing a similar title.

NATHANIEL LLOYD, OF MANCHESTER, PATTERN DESIGNER; AND HENRY ROWBOTHAM, OF THE SAME PLACE, CALICO PRINTER, *for certain improvements in thickening and preparing colours for printing calicoes and other substances.* Petty Bag Office, July 26, 1841.

These improvements consist in the employment of brown sago, instead of the gums commonly used for the above purposes. The sago is calcined, and afterwards mixed with water, and heated to 200° or 212° of Fahrenheit. The claim is to the substitution or use of sago, calcined from the granulated state, or employed in any other form, for the purpose of thickening and preparing colours for printing, in place of the gums now commonly used.

CORNELIUS ALFRED JAQUIN, OF HUGGIN LANE, WOOD STREET, MERCHANT, *for improvements in the manufacture of covered buttons, and in preparing metal surfaces for such manufacture and other purposes.*—Enrolment Office, July 26, 1841.

Thin sheets of metal are coated on one side with copal varnish thinned with turpentine, and coloured according to the colour of the flock to be employed, and then heated in an oven to about 150° Fahr. When cold the following composition is applied; a pound of white lead is mixed with a pint of boiled linseed oil, and half a gill of free gold size, and coloured as before. The metal is then placed on a sheet of leather or canvass and a quantity of flock, similar to that used for paper hangings, is sifted over the prepared surface; when the surface is well covered with flock, the composition is left to dry for twelve hours or more; the superfluous flock is then shaken off, and the metal placed in a rack for a few days, when it will be fit for use.

The metal prepared in this way may then be formed into collets or shells for the backs of buttons, with the prepared side outwards, or it may be employed for any other useful purpose.

The claim is to the mode of improving the manufacture of buttons by applying flocked metal backed surfaces thereto, and preparing metal surfaces in a similar manner for other purposes.

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# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 941.] SATURDAY, AUGUST 21, 1841. [Price 6d.

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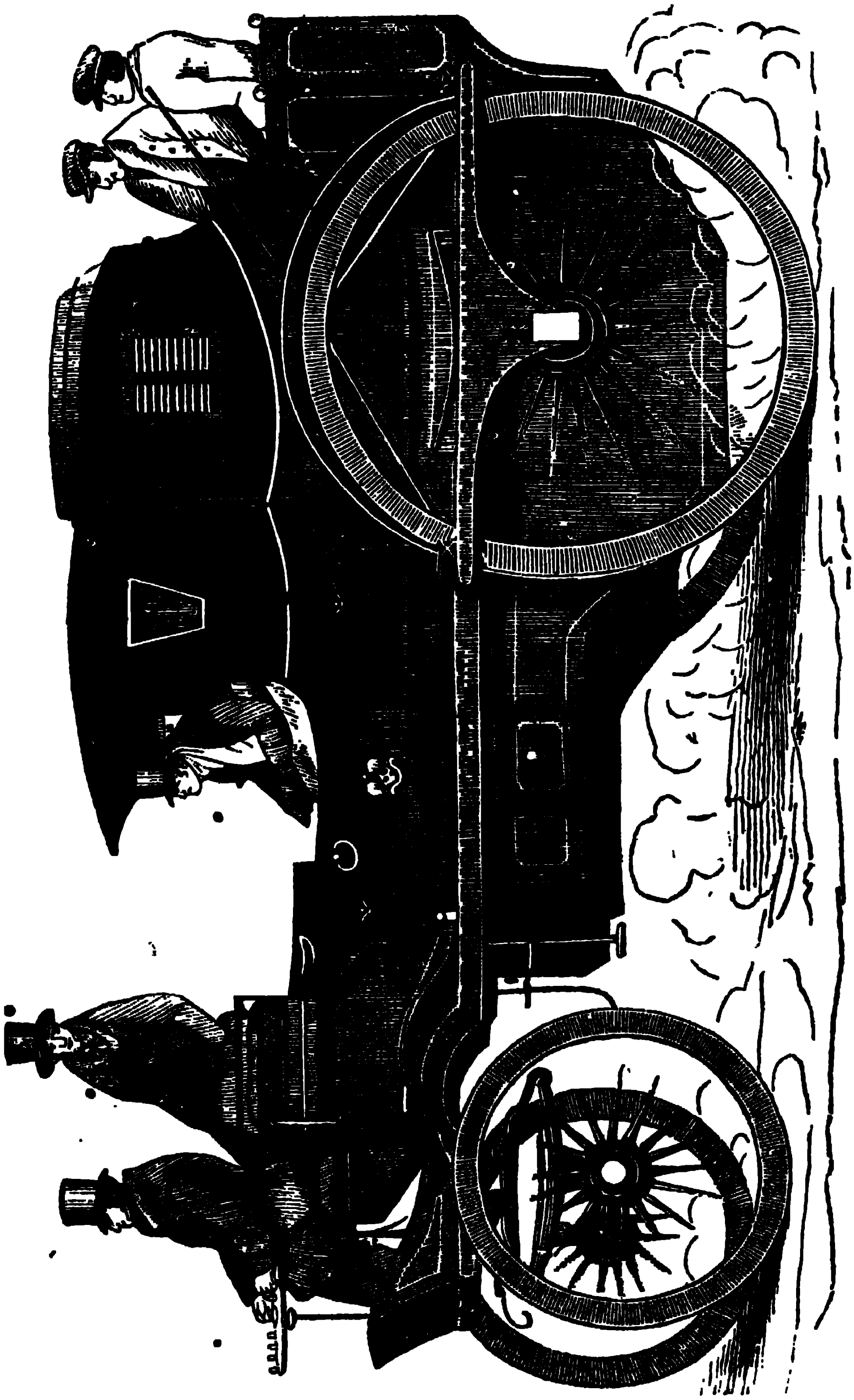


MR. HILLS' STEAM CARRIAGE FOR COMMON ROADS.

## MR. HILLS'S STEAM-CARRIAGE FOR COMMON ROADS.

The steam locomotionists are again on the road. "The General Steam-coach Company," have, during the past week, been making daily trips from the York and Albany Hotel, at the north eastern extremity of the Regent's Park, to the Manor House at Tottenham, and back, with a steam carriage of Mr. Squire's. We accompanied them on Monday last, when the distance, which is said to be eight miles and a half, was cleverly done in half an hour. The road however is in fine condition, and the undulations inconsiderable: so that these short experimental trips prove nothing beyond the power of the carriage to run on the best of roads—the capability of the boiler to produce steam enough to maintain that speed for a short period of time—and the perfect command which the conductor has over the movements of the carriage; all of them facts, long since proved to demonstration by Gurney, Hancock, Heaton, and other previous experimentalists in this line.

As long back as 1831, a Select Committee of the House of Commons, after a careful examination of several distinguished civil engineers, reported—"That steam carriages could ascend hills of considerable inclination with facility and safety—that they were perfectly safe for passengers—that they would become a speedier and cheaper mode of conveyance than carriages drawn by horses—that, with the slightest exertion, they might be stopped and turned under circumstances where horses were totally unmanageable—that they would not act so injuriously on common roads as the feet of horses—that the substitution of inanimate for animal power in draught on common roads is one of the most important improvements in the means of internal communication ever yet introduced; and its practicability had been fully established."

Notwithstanding the apparent conclusiveness of this report, and the constantly-reiterated assertion, "that the successful substitution of steam for animal power on turnpike roads is no longer doubtful," we are, unfortunately, but little, if any nearer the practical realization of these boasted advantages than we were ten years ago.

Great as the demand now is for additional accommodation on several lines of road, and desirable as is this mode of competing with and counteracting the exorbitant charges of the gigantic and growing railway monopoly;—loudly as the vested but fast-decaying interests of a particular class of persons call for a common road traffic to sustain and to retrieve their falling fortunes: notwithstanding all these and many other causes combine at this particular crisis to hold out more than ordinary inducements for the employment of capital in this hitherto neglected channel—common road locomotion seems destined only to amuse the present generation—to benefit the future.

The General Steam-coach Company state, in their prospectus, "that while they confidently believe the improved steam-coach which they have engaged, and propose to employ in the first instance, to be the most perfect now known or patented in England, they do not bind themselves to adhere *to any particular invention*, longer than its intrinsic worth shall render prudent, but will avail themselves of every valuable discovery tending to promote steam-coach conveyance."

Under these circumstances, therefore, we feel it our duty to call the attention of this company, and of all who are anxious to forward the successful introduction of common road locomotion, to the experiments of Mr. F. Hills, of Deptford, who has patented several improvements which, in practice, are stated to have fully realised his most sanguine expectations, and appear to us of great value. In constructing a boiler capable of producing steam with a rapidity equal to every exigency—in bringing the weight of the whole of the machinery within moderate and practical limits—and in greatly reducing the cost of working, by avoiding the usual excessive wear and tear, Mr. Hills's principal merits consist.

Instead of making short and showy trips on good suburban roads, Mr. Hills has selected for his CURRICULUM those roads which, from the peculiar difficulties they present, are likely to point out every variety of provision that need be made, or circumstance that is to be guarded against. The Windsor, Brigh-

ton, Hastings, and similar roads, have been traversed by him with uniform success.

Perhaps no more satisfactory performance of a common road steam-carriage could be cited, than Mr. Hills's trip to Hastings (64 miles) and back in one day; each journey accomplished in one-half the time occupied by the coaches.

We accompanied Mr. Hills, about twelve months since, in a short run up and down the hills about Blackheath, Bromley, and its neighbourhood; and on Friday last we again had the pleasure of accompanying him in a delightful trip on the Hastings road, as far as Tunbridge, and back. The manner in which his carriage took all the hills,* both in the ascent and descent, proved how completely every difficulty on this head had been surmounted.

The appearance of Mr. Hills's carriage is very well conveyed by the engraving which forms our frontispiece this week. It consists, in the first place, of a strong frame mounted on substantial springs; the hinder part is occupied by the boiler, furnace, and water-tanks, with a dickey for an engineer and stoker, &c.

In front of these an elegant britzka body, capable of holding six persons inside, and three on the box, besides the conductor in front, is suspended upon the frame by another set of springs, so that the motion of the carriage is delightfully easy and agreeable. The carriage is propelled by a pair of ten-inch cylinders and pistons, lying horizontally beneath the carriage, which act on two nine-inch cranks on the main axle, which can be coupled to either of the driving-wheels at pleasure. The driving-wheels are 6 feet 6 inches in diameter.

The weight of the boiler, when empty, is 23 cwt. When filled, it holds about 60 gallons of water, and 120 gallons more are contained in the tanks which surround it. The quantity of water taken in at each of the stations, (which are arranged, as near as possible, in 8-mile stages,) varies from 80 to 100 gallons. The total weight of the carriage, including water, coke, and twelve persons, is under four tons.

When working on heavy and uneven roads, (such as are encountered in travelling to Hastings, for instance,) the steam pressure is 70 lbs. on the square inch, but on good level roads a pressure of 60 lbs. is amply sufficient. The average speed on the former roads is full 16 miles an hour, throughout the journey; on level roads, a speed of 25 miles has frequently been realised. Three miles have been repeatedly accomplished in 7½ minutes. In long journeys, however, on public roads, the speed is regulated more by the casual obstructions, arising from the ordinary traffic of the road, than by the power of the steam. It is always necessary to slacken the speed in meeting or passing vehicles drawn by horses, to prevent their shying, which they nearly all do if passed at a great velocity; while few horses take offence at the steam carriage, if travelling at a speed somewhat resembling their own.

The actual cost of steam travelling on turnpike-roads can never be satisfactorily determined until the system is reduced to practice, and experience has pointed out the most economical mode of working—and this problem in steam locomotion, albeit the most important, is now the only one that remains to be solved. Mr. Hill's long-continued experience, as far as it goes, fully justifies the belief, "that passengers can be conveyed by steam-coaches at *half* the expense, and with *double* the speed, of a stage-coach."

* Quarry-hill is a rise of 1 in 13; and River-hill, said by the coachmen to be the worst hill in the country, rises 1 in 12.

## RUSSELL ON STEAM AND STEAM NAVIGATION.

*On the Nature, Properties, and Applications of Steam, and on Steam Navigation. From the Seventh Edition of the Encyclopædia Britannica. By John Scott Russell, M.A., F.R.S.E., Vice-President of the Society of Arts for Scotland, &c. &c. &c.* Edinburgh: Adam and Charles Black. 378 pp. 12mo., with 15 plates.

(Third Notice.)

If there exist in nature an agent more simple, more powerful, or cheaper, than that of steam, capable, by human ingenuity, of being applied mechanically to the purposes of life, we have all the authority of the past to predict that the means will be discovered as time rolls on. But we may perhaps reasonably conclude, that this period will not arrive until our present locomotive power shall

have been brought to its utmost possible perfection. In those single lifting engines in Cornwall, where steam is used expansively at a very high pressure, and a sufficiently large area of piston is made to give out the whole effective power of the steam before it enters the condenser; where a judicious system of slow combustion and appropriate boilers are combined with the best clothing and other minute advantages, we may in vain expect any great advance in their present performance. But, with these improvements carried to their full extent, we think their average duty is capable of being kept up to very near their highest duty. If the same attention were paid to their daily action, as for special trials of their powers, we see no cause to prevent a continuance of a greater approximation to their best performance; allowing sufficient deduction for slight imperfections of machinery between the times of putting the whole in the best order. We may therefore consider these engines as nearly perfect, or capable of being made so by following out, to the extreme limit, those conditions now well ascertained to insure most duty. But as a means of water transit, the steam-engine is, in respect of consumption of fuel, comparatively in a rude state; as imperfect, on the average, when contrasted in duty with the Cornish engine, as Newcomen's was to Watt's. In marine engines, therefore, where a combination of every possible advantage, however minute, is far more required than for land engines, we may reasonably expect such improvements as shall render their duty equal to the best Cornish engine. There is nothing in the steam-engine itself, nor in the nature of steam, to confine improvement to one class of engines. The moment the true causes of the superiority of the Cornish engine shall be ascertained, human ingenuity will place the marine on a level with it. To subscribe to the mere assertion, that the different purposes to which the two engines are applied must ever prevent an equality of duty, is at once to stop investigation. Nothing can be more unsound, nothing more injurious to the improvement of the marine engine. Let but the real causes of difference in duty be determined, and we are sure that means will be discovered to give to the now inferior engine the same effect. We are a nation of mechanics, as well as of shopkeepers; and there is invention enough among our ingenious artisans to discover the means, as soon as their attention is directed in the right channel. The physician must first discover the cause of a disease, before he can cure it. We may safely, therefore, assure, as an incentive to investigation, a large fortune to him who shall approximate the duty of the rotative marine engine to that of the best Cornish single lifting engine; and also the remembrance of his name to the most distant posterity, as long as the steam-engine shall last.

The nation is not yet alive to the importance of the wanted discovery; the public are totally ignorant of the anomaly; and the mercantile community, whose millions are invested in steam navigation, will perhaps scarcely believe in its existence. In the present state of steam-engine science, it cannot be denied, that the metropolis, centre, as it is, of the commerce, of the arts, of the wealth, and luxury of the world, is far surpassed by the scattered population of the mining districts of Cornwall. Would we show the foreigner our perfection in this department of the intellect of Great Britain—the mighty operations performed by the smallest known consumption of fuel—we must beg him to go two hundred and fifty miles from our city. If of an intelligent mind, he will express his astonishment that marine engines, where economy of fuel is of incomparable importance, should consume double the quantity, which the Cornish do. He will ask explanation of the singularity, and apply to our most renowned engineers for the information. We should then be convicted of the most lamentable and disgraceful ignorance. They must say—"Really, we cannot tell you; we do not ourselves understand the causes of the effects of our own works." What would be his surprise and contempt! An insular nation, ever first at sea; possessing many colonies, each larger than itself, a speedy communication with which is of the last importance; having an unlimited means of steam navigation, is yet limited in the use of it by the enormous quantity of fuel that must be carried; whilst a district, comparatively unknown, has been for many years carrying on great operations with one-half of the consumption. We cannot dwell upon all the important changes that rise before us, which must inevitably ensue from the

ability to perform voyages of double the length with the same fuel. A revolution in distant communications, as surprising as the present state of steam navigation, would be the result; and yet we stand still. We build enormous ships of 2 and 3,000 tons, three-fourths of whose space is occupied by machinery and fuel, without first satisfying ourselves whether the superiority of the Cornish engines cannot be adopted, by some new arrangement of rotative engines. What this arrangement should be we are unable to determine, from ignorance of the causes of the superiority; to these, therefore, we would draw attention, and we cannot but lament that they have been so long allowed to remain undiscovered. It is by no means creditable to our engineers. Were the question of equal importance to France and America, as to Great Britain, a government commission had long ago set the subject in its true light. We cannot but admire the superior genius of legislation in France, in all matters relating to mind, and scientific investigation; as also the superior treatment men of science and literature receive from the government and the people. But it does not seem consistent with the wisdom, the policy, or spirit of the constitution of this country, to protect its richest sources of power and glory. Poor, indeed, would be the state of science here, and small hope of its progress for the future, did it depend upon the fostering protection of our government. Commissions of stolidity, and jobs of venality, which never yet gave a new idea to the world, nor advanced one degree the cause of intellect, are got up with surprising alacrity, and the most unblushing effrontery for political purposes, at a yearly expense of many thousands to the country. The wasteful prodigality of each succeeding administration is insufficient to satisfy the cravings of party poverty, whose appetite, like the horse-leech, still cries, "Give! give!" But where find we commissions of intellect—jobs of the intelligence of the nation, to promote the interests of science; for the investigation of principles; the advancement of mind? Government has, indeed, seldom done any thing to assist the science or the useful arts; on the contrary, by a disgraceful system of patent laws, and a burdensome expense, she has acted the part of an unnatural mother; and, from deference to a few rich monopolists, repressed as much as possible, instead of giving every encouragement to the inventive talent of the country. This species of intellect has almost universally been found among the most industrious and poorest classes of the community, upon whom the hardships of the existing laws have fallen with terrible severity. They squeeze the money from their pockets, and, until some recent alterations, mocked their claims for protection by the vilest quibbles. Every advance is left to the enterprise and struggles of the people themselves.

If government will not appoint proper persons to investigate, for the national benefit, the causes of the great saving in fuel, in the mining districts, we must press it urgently upon individual intelligence. We cannot too strongly draw attention to what has been done in Cornwall. Since 1814, the talented engineers of that county have, by their improvements, saved the surprising revenue of 84,300*l.* a-year to the proprietors of the mines, calculating the coals at 17s. per ton. [Lean's Historical Statement, p. 146.] They have thus put into their pockets a clear gain, in twenty-six years, of 2,191,800*l.*; and whilst these advances to perfection have been made in the single lifting engine, the rotative consumes, on the average, as much now as it did in 1787! This enormous saving in Cornwall has been made on fifty-four engines alone. If, then, their present improvements could be applied to all the manufacturing and marine engines employed on land and sea in Great Britain, the saving to the nation, in coals, would be of a magnitude truly astonishing. It has been sufficiently established, we take for granted, to be considered a fact, that these rotative engines consume, at the lowest calculation, on an average, double the quantity of fuel of the Cornish engine; and we are more justified in assuming, from the experience of the past and every analogy, that such saving can be effected, as well in the rotative as in the Cornish engine, when the causes are ascertained, than that they cannot. At present, so little interest has the question excited, in proportion to its importance, that the first engineers in our country are obliged to confess that no rational causes have been advanced in explanation. The theory of percussion has been relied on by Mr. Parkes; but it was not satisfactorily received, nor has it since been adopted by those in highest repute as practical and scientific engineers; it seems now to be given up. The question remains

as unsettled as ever. The design and limits of this notice preclude our interposing our own private opinion on this nice and interesting subject. Neither do we feel sure—in consequence of the omission of some experiments, and of the facts on record, though numerous, not being taken with sufficient minuteness—that we could, as yet, form a correct judgment.

We were disappointed in not finding, in Mr. Russell's work, the slightest allusion to this important subject. It is the greatest defect in a treatise otherwise valuable to science; and we regret the loss the more, since we believe his powers of investigation and analysis would well fit him for the investigation. No notice is even taken of the Indicator, and its diagrams, as a means of determining the actual power of an engine. We press this omission on our author's attention; and suggest the propriety, nay, the necessity, in justice to his readers, of publishing a separate chapter on this interesting and philosophical inquiry. No paper would be more eagerly welcomed; no investigation would tend more to the advancement of science, and the improvement of the rotative engine. Nor could the British Association appropriate a portion of its funds to a more important inquiry for the national benefit, and particularly for the commercial interests of Great Britain. It is a field for investigation, at this time, of a peculiarly interesting nature, and cannot but lead to the further and more rapid extension of steam navigation. Altogether, viewed in its different relations to the trade, cost of materials, and commerce of the country, we are not acquainted, in the whole range of science, with a subject of greater magnitude.

The general substitution of steam—the dearest power, for wind navigation the cheapest—has one great evil to contend against, which must be removed before it can reach its limits of extension; namely, the enormous consumption of fuel.

Our correspondent, "Scalpel," has, in an able paper in No. 927, drawn a comparison between the duty of Mr. Watt's rotative engines and the present; and come to the startling conclusion that, as far as the practice and internal arrangements of the engine are concerned, we have rather retrograded than advanced in duty since 1787; seeing that the superior performance of any such engine, now, is not more than can be fairly accounted for by the use of expansive steam alone. We would direct Mr. Russell's attention to this paper, as it seems to have been prepared from a considerable mass of materials, and from other authorities which have the reputation of standard works on the steam-engine. We would also call his attention to one or two other points deserving of investigation.

Our author observes, that American engines travel at double the speed of engines in this country, making a progress of 400, 450, and 500 feet a minute; and strongly urges us to double the speed in England, by enlarging the eduction valves. As this recommendation may lead to much error and wasteful expenditure; and as we think it a hasty conclusion to come to, without any facts to justify the practice, we press this upon our author's further consideration. The American engines are no guide, for they use steam at a very high pressure, and thus make up in duty any loss from imperfect cylinder exhaustion. We think there is much truth in what has been advanced in our pages, that *time* is required for condensation, so that if double the speed is obtained, only half the usual time is allowed for exhaustion of the cylinder. Our present rotative engines do not perform half of the duty of the Cornish engines, and they travel more than double their speed; what, then, is likely to be the resistance to the piston from uncondensed vapour, in the American engines, at double our speed? Certain it is, that the slowest moving engines in the world perform the greatest duty in the world. Besides, on principle, we are not disposed to encourage, upon mere supposition, the subversion of important theories, found in practice to succeed so well. We cannot doubt that a mind like that of James Watt formed his practice on sufficient thought and experiment; and until facts of value, or at least some show of reason, (for Mr. Russell does not condescend to give us either,) shall be brought forward to controvert his opinion, we cannot but caution the public against being led away, by speculative doctrines only, mere hypotheses, to alter what has been so long observed. Our author has not yet, we think, secured for himself a name of that omnipotence in science, as to entitle his mere authority to alter the matured judgment and invention of such a man as Watt, confirmed by the practice of eminent engineers for

half a century. When individuals contend for alterations of a system like this, they ought at least to support the novel theory. Mr. Russell should, at any rate, have stated some better reason for insisting on the error of Mr. Watt, than that the swiftest steam-boats in America worked their engines at double our speed; as if lines of least resistance, and proportion of power to tonnage, were not the causes of their rapid movement through the water.

In investigating the causes of the superior duty of Cornish engines, some attention should, we think, be paid to the following, among other questions. When an engine is not doing its extreme or trial duty, is the cause due solely to an inferior state of the machinery? If the same steam pressure is used expansively, and the pit work is in the same order, it should be determined with accuracy what are the causes that reduce the duty from 123,300,593 lbs., done by the Wheal-Vor engine (Borlase's,) to an average o 83,437,497 lbs. Does the engine, in the latter case, make more strokes a minute, and is the eduction valve opened less quickly than usual before the steam valve?. What is the cylinder exhaustion in the two performances? Under the same circumstances, are the same results always obtained? Let us not reason on mistaken facts. Unless they are pretty certain and invariable, we may seek in vain to deduce a rational theory of what causes produce the effects we see. We think experiments should then be made with two or more engines of the same size, and under the same circumstances, as nearly as they admit. There are many engines in Cornwall of the same class, and the liberal facilities of inspection that have ever distinguished this county will, we are sure, be continued. The differences in duty might then be traced to various forms of boilers, superior clothing, better cylinder-exhaustion, more powerful fuel, the use expansively of higher pressure steam, and the items of difference assigned to each. We are not aware that, in the late experiments, the Indicator was applied at all to ascertain the cylinder exhaustion, but merely the steam pressure. Facts minutely and accurately taken, on a sufficient number of engines, with Indicators most carefully prepared each time, so applied that the diagrams may present the extreme sweep of every variation, and afterwards well arranged, would soon lead to a complete explanation of what is now an unexplained phenomenon. If, when this is done, and the actual power of Cornish engines reduced, with perfect accuracy, to the measure of actual (not nominal) horse power of the rotative engine, experiments of a similar nature should be made on manufacturing and marine engines: the difference in consumption would then be properly determined, and assigned to the true causes. In making experiments with Indicators, we would observe, from our own knowledge of the false results that have been obtained by connecting the string improperly, that some previous diagrams should be taken, in various ways, to determine the fairest and most correct sweep. To measure the power of these enormous machines by instruments so minute and delicate, requires all the caution of the most accurate science.

We expected to have been enabled to conclude in this number our strictures on Mr. Russell's book; but we find on our notes, so much yet remaining to be observed upon, touching especially the comparative services of the Thames and Clyde marine engine makers, that we must trespass on the attention of our readers with a a fourth and concluding notice next week.

*Errata.*—In our second notice, for "Bishop Butler," in note at foot of col. 2, page 128, read "Bishop Watson;" and for "Ireland," in note p. 137, read "Scotland."

### CLYDE-BUILT STEAMERS.

Sir,—Your correspondent A. M., in the Magazine for July, has asked a number of questions which it would be libellous to answer, as to the merits of Clyde-built Steamers. I saw the *Robert Burns*, from the Clyde, on the day of her arrival in the Thames, and observed that she was not nearly so fast as the slowest of the Gravesend boats, which happened to be going up the river at the same time. Perhaps it might be the fresh water which prevented her going so fast as she did in the Clyde!

Your correspondent has not given his name; perhaps it might have then appeared too much like the puff direct; however, as I have no particular interest to serve, I subscribe mine, and remain,

Yours truly, GEORGE BAYLEY.

1, Addington-place, Camberwell, Aug. 12, 1841.

### THE NEW ARRANGEMENT FOR MARINE STEAM-ENGINES, (P. 118.)

We gave in our last number a drawing and description, communicated by a correspondent, (S. C.,) of a new arrangement for marine steam-engines, by which a very considerable saving in room, and also (we presume) of expense, may be effected. We were not then aware, and we hope our correspondent was equally so, that this arrangement is included among the improvements last patented by Mr. Joseph Maudslay, (1841,) and that two pairs of engines on this plan have actually been for some time in progress at Messrs. Maudslay, Sons, and Field's manufactory, Lambeth. Having had these facts established to our satisfaction, justice as well to our readers as to Mr. Maudslay requires that we should thus promptly give publicity to them; lest any of the former, misled by the *pro bono publico* character of our correspondent's disclosure, should be betrayed into the mistake of building engines on the improved plan in question, without licence from the patentee; or Mr. Maudslay miss any of the fame or profit to which he is rightly entitled, as the sole inventor and patentee.

### PERFORMANCES OF THE CORNISH ENGINES—THEORY OF GRAVITATION, &c.

Sir,—One subject which seems much to puzzle the scientific men of the present day is, in what manner to account for the extraordinary performance of the Cornish Pumping Engine—the *effect* obtained being apparently vastly superior to the *cause* producing it, according to the present accurate and well-defined modes of calculation. It has therefore, after ample allowances for the great care and nursing bestowed on these engines, been referred by many scientific men to the operation of some *mysterious agent* not heretofore explained, or taken into calculation. It is pretty certain, that steam, as used in these engines, is made to produce its maximum *practical* effect, and this will of course form a large item in considering their superiority over other kinds of engines. The undiscovered agent, it appears, must account for the rest; and doubtless, that man will get the credit of being a clever fellow, who now shows what this agent really is. However, to proceed. An idea occurred to me some time back, which I think may *possibly* be the means of unravelling the whole affair; and if so, it will prove that the Mining Engine does not in reality perform the extraordinary duty allotted to it, although it may actually raise the quantity of water alleged, and that the whole mystery has arisen from scientific men having based their arguments on an *effect*, instead of on the *cause*, which produced that effect. We are constantly being told that some certain engine, by the combustion of a bushel of coal, has raised, so and so—say fifty millions of pounds weight a foot high. Explain this. What do you mean by the term weight? What is *weight?* "Why," says one of your unscientific readers, "the *weight* of a thing makes it fall towards the earth. Take up that pail of water—and hold it in your hand—and you will soon find out what weight is." I apply myself, and find it requires considerable muscular exertion to raise it—this, of course, makes me cognizant of the fact itself; but does not explain the *cause* of it—the *reason* why I am obliged to use muscular exertion to raise the pail of water from the earth. I then apply to your scientific reader who informs me—"that there is a constant power of attraction exerted by all bodies or forms of matter on each other—and consequently, by the earth, as a whole, on all bodies or forms of matter within its influence—commonly called the Attraction of Gravitation, or Gravity—and that the *weight* of the pail of water is *caused* by the attraction of gravitation exerted by the earth on *it*—that the muscular exertion was necessary to *overcome* this constant attraction, or the water could neither be raised from the earth, nor supported when raised. That *weight*, therefore, is merely the *effect* of this constant power of attraction, and is the evidence apparent to our senses, by which we are enabled to judge of its intensity or quantity; the different weights or *specific gravity* of the same bulk of different substances (as iron or water) being merely indicative of the degree of *energy* exerted by the attractive power of the earth on each of them in drawing them towards

itself." The term *weight*, therefore, as commonly used and understood, conveys a false idea to most persons. It seems to intimate that a body, or substance *possesses a power* of falling—and when it is said that a horse's power will raise 33,000 pounds weight a foot high, it seems to intimate, and is generally understood, that the water itself possesses some innate faculty or power of falling, which renders necessary the exertion of great mechanical power to overcome it.

From these observations it appears, that, correctly speaking, the power of the Cornish Pumping Engine, is expended in *overcoming* the attraction exerted by the earth on the water that is raised from the depth of the mine. It is evident, therefore, that although water is ostensibly and really the substance acted *upon*—the attraction of gravitation is the power, which the force of the engine is exerted directly *against;* and had this word, *attraction*, been used in estimating the power of the steam-engine, it could hardly have escaped an intelligent mining engineer, that an allowance must be made in favour of the engine, in consequence of the degree of attraction exerted on the lower part of the column of water, by the earth above the bottom of the mine. Some mines, we know, are of a vast depth, and it follows, that although the immense bulk of the earth is still attracting the water at the bottom as before, yet this attraction must be perfectly neutralized by the attraction exerted on it in an opposite direction; by the vast mass of earth through which the shaft has been cut, and which may be compared to the effect that would be produced by placing a piece of iron within the sphere of attraction of two magnets of very unequal size. It is as well here to observe, that Nature knows no such terms as *up* or *down*—*above* or *below.* The vast globe on which we live, keeps whirling round and round, day after day, making a complete revolution in twenty-four hours; therefore, in relation to the sun, we are now (our senses would affirm) at *top*, standing on our feet; but twelve hours hence, we shall be at *bottom*—our heels upwards and heads downwards; yet still prevented falling away from the earth by some invisible but mighty power, which *binds* us to it as firmly as in the first case; and not only *us*, but the mountains, rocks, seas, and the air we breathe, which are equally under its influence—and this stupendous power is the ever-constant attraction of gravitation. However, it is not my intention to illustrate or enlarge upon the principle of gravitation unnecessarily, as it is sufficiently well understood; but simply to mention what I consider necessary to elucidate the subject, in accordance with the generally-received theory; but which must, however, lead us rather deeply into it. There is *really*, then, (although I must use the term to make myself understood) no *up* and no *down*, and a person who can realize this idea will see clearly that the bulk of earth (to use the common expression) *above* the bottom of the mine, will exert on any substance (say water) placed there, an equal degree of attraction with the same bulk of earth immediately *below* the bottom, will, in fact, exactly neutralize the effect, or power of an equal bulk in the opposite direction. To give a full idea of the effect of this neutralization as regards *weight* and *gravitation*—let us suppose a vacancy at the centre of the earth. Here we should find no such thing—no such sensation as *weight;* and yet the earth would be still exerting its attractive force on us as at the surface; and the cause is obviously, that the attractive power is exerted on us with equal energy, in, or from *every* direction alike. Imagine, therefore, engineers, the piston of a steam-engine, with the steam admitted at the same time both *above* and *below.* It is obvious, that in this case the same amount of power would be exerted on the piston *each* way, as would be exerted in producing sensible power if only on *one* side of it. These powers, will now, however, neutralize each other, and consequently, the piston, although acted on powerfully by each, will not *feel* that power, or will have no sensation of *force.* So in like manner, a man at the centre of the earth, although acted on powerfully in all directions by the attraction of the earth around him, would not in the least *feel* that power, and would have no sensation of *weight.* It is rather amusing to let the imagination dwell on the novel sensations a person so situated would experience. He would float in the air

and his obvious means of locomotion would be wings, or perhaps to be in the last fashion—a screw propeller. He would have lost the power of locomotion by the usual means, by losing his weight; and would, if he put out his foot to take a step, be doubtless surprised to find himself bounding about like an India-rubber ball. Leaving cohesion out of the question, he would be able to lift a mountain—for the mountain would be destitute of weight as well as himself. He would begin to think himself all-powerful, although he might in relinquishing his grasp of anything small, be rather annoyed to see it bound away from him merely by the impetus it acquired from his quitting hold of it. However, I will not multiply these instances. I think that no one will deny, on reflection, that such would actually be the effect; and therefore it follows, as a matter of course, that as the attraction of gravitation exerts no perceptible or sensible power on a substance at the centre of the earth, and a great amount of power at the circumference, that it must diminish in a certain ratio of progression from the circumference to the centre; and that although this difference may not appear to be *great* at a short distance from the circumference, yet it *must* have a certain value. Here then lies the question. What is this ratio? And what is the *difference* of attractive power at the depth of the Cornish mines? This will involve the consideration of various subjects and theories; some tolerably well established, and others not so; and to commence, it will be as well to mention the known fact, that the attractive power of a lofty mountain is sufficient to draw a plumb line at its base out of the perpendicular. Here then is at once a well-attested instance of the attractive power of a part of the earth; modifying, or partly neutralizing the attractive power of the whole, which establishes fully the fact, that such a phenomenon actually takes place, and proves the correctness of the theory. I will next consider, to the best of my ability, the present theory of the ratio of force with which the attractive power exerts itself—premising that I have not read so much on the subject as perhaps I should have done.

I extract the following from *Grier's Mechanics' Dictionary*:—

"The power of gravity at any given place is *greatest* at the earth's surface; from whence it decreases both upward and downward, but not both ways in the same proportion. The force of gravity upward decreases as the square of the distance from the centre of gravity increases, so that at a double distance from the centre above the surface, the force would be only one-fourth, what it is at the surface. The surface of the earth is in round numbers 4,000 miles from the centre; if, then, a body at the surface weighs four pounds, and falls through 16 feet in a second of time, it will at double this distance weigh but one pound, and will fall through, but 4 feet in a second of time. Below the surface of the earth, the power of gravity diminishes in such a manner, that its intensity is in the direct ratio of the distance from the centre, and not as the square of the distance; so that at a distance of 2,000 miles, which is half a semi-diameter from the centre, the force would be but half what it is at the surface; at one-third of a semi-diameter, the force would be one-third, and the same ratio is applicable to all other distances. But although the force of gravity, strictly speaking, varies in the manner just stated, in receding from the surface, its operation at short distances is considered uniform; a quarter, or even half a mile bearing so small a proportion to the earth's radius, that the difference is too insignificant to be noticed in calculations. As the power of gravity appertains to every particle of matter, and the gravitating power of entire bodies consists of that of all their parts, under certain circumstances, the gravitating power of a part of the earth (as a lofty mountain) somewhat counteracts that of the whole earth."

Again, in Reid's little work on the Steam Engine, page 10:

"When a heavy body is suspended by a wire, *its* gravity pulls it towards the ground, causes it to hang perpendicularly, giving it that property of downward force, which we call *weight*. This attractive force is found to operate between all bodies at whatever distances, and it acts with a force directly proportional to the mass of matter; and in inverse proportion to the square of the distance. Thus, if the distance be 1 and the attractice force 1, (the mass remaining the same (the following proportions will hold."

| "Distance. | Force. |
|---|---|
| 1 | 1 |
| $\frac{1}{2}$ | 4 |
| $\frac{1}{3}$ | 9 |
| 2 | $\frac{1}{4}$ |
| 3 | $\frac{1}{9}$ |
| 5 | $\frac{1}{25}$." |

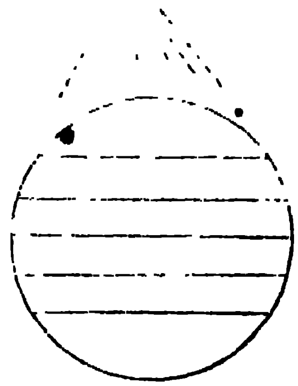
I will add,

| | |
|---|---|
| 60 | $\frac{1}{3600}$ |

"The earth being of a globular form, and so enormous a mass, compared with any of the bodies on its surface, *in regard to them*, may be looked on as a fixed body, drawing towards its centre with a prodigious force every thing which rests on its surface."

These theories I assume to be those generally received as correct, although I do not see how they can ever have been *proved* to be so; and speaking first of the earth's attraction on substances *outside* of its mass, we cannot fail to be struck with the vast amount of difference consequent on the consideration of *distance*. We will say the earth's semi-diameter is 4,000 miles, and a lump of iron on its surface *weighs* 3,600lbs; at two semi-diameters from the centre, or 4,000 miles from the surface, it would *weigh* but 900lbs; at three semi-diameters, or 8000 miles, 400lbs.; at five semi-diameters, or 16,000 miles, 144 lbs.; at 60 semi-diameters, or 240,000 miles, being the distance of the moon, its weight would be only 1lb. It will here be observed that the difference of weight or attractive force is by far greater the nearer we approach the earth, and in fact we find by computation that the power exerted is *greater* in the first 4,000 miles than in the whole remaining 236,000 between it and the moon. So much then, for the consideration of distance — the mean power exerted in the first one radial distance is *greater* than in the whole remaining 59 *put together*. It is likewise seen that the whole theory *hangs* on the earth's semi-diameter of 4,000 miles, and in consequence assumes that the *centre* of the earth is always the *centre* of its attractive power. A little consideration has induced me to think that this theory defeats itself, and simply from the modification introduced by the one circumstance of *distance*. Acting on a body at the distance of the moon, (60 times the earth's diameter,) it is very easy to perceive that the *centre* of the earth's attractive power is actually the centre of the earth, or very *nearly* so; but at the distance of only 4,000 miles, we cannot fail to see that the *near* side of the earth is but 4,000 miles distant from the object, while the *off* side is 12,000. Now we are told that the centre of gravity appertains to every particle of matter—that the gravitating power of entire bodies consists of, or is derived from that of all their parts—and that the ratio of attraction is according to distance; a rule indeed is given by which, in this case, we find that the *near* side of the earth is attracting the mass of iron with nine times the energy that the *off* side is. I have divided the earth, fig. 1, into six parts or slices; each slice, of course, has a different attractive energy according to the various distances; and

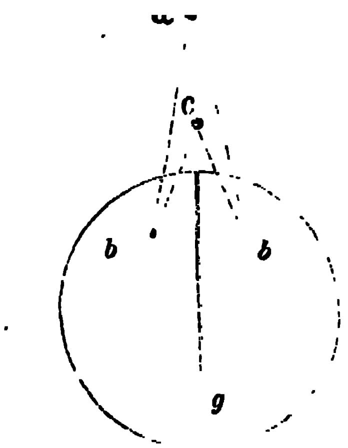
Fig. 1.



we ought, I conceive, in finding the *centre* of attraction, to calculate the different powers of the different slices, and take the geometrical mean as the centre of the attractive power; but this plan, it is obvious, would not place it in the *centre* of the earth, and perhaps not more than 1,500 miles beneath the surface. What then, I ask, becomes of the relation of the earth's semi-diameter to the ratio of progression on which the whole theory depends? It seems to be all very well at a *great* distance, but at a *small* distance the theory seems upset by its own first principle. In fact, if my ideas are correct, there can be no *fixed* centre of gravity. The earth's attraction being exerted on bodies at different distances, would cause a different *centre* of attraction as regarded *each* distance, and as a body from any distance advanced towards the earth, the earth's centre of attraction would advance towards the body. To give at once the result of my cogitations on the subject, I am inclined to think that the *centre* of the attractive power exerted by the whole earth on a man standing on its surface, would be found not a very great distance, (say four or five miles) beneath his feet, and by *slashingly* applying the above theory we might find that about one-eighth of

the entire gravitating power of the earth was exerted by the first 100 yards over which he stood. The above proposition of calculating the power of the different parts of the earth of course would depend for correctness on the assumption of the earth being solid, and of the same density throughout, which is very uncertain. There is, however, another proposition which would modify the above, which is, that the *angle* of attraction becomes more obtuse the nearer the body approaches the earth, (see fig. 2.) Suppose the earth divided equally by a perpendicular line, ($g$,) it

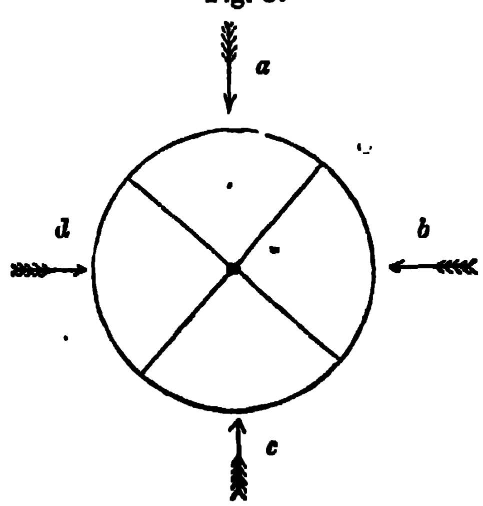
Fig. 2.




will be apparent that *each half* will have *its own* centre of attraction, *bb*, and will act on the substance ($a$) with equal forces, and that *each*, as a *whole*, will form its *centre* of attraction, and act at an *angle*, which will not have the same *beneficial* amount of attraction as a directly *perpendicular* pull, although as the force of each is equal, the effect is to draw the body perpendicularly towards the *centre* of the earth. It is evident that the disadvantage of attracting at an angle will *increase* as the body nears the earth, ($c$,) in consequence of the angle becoming more *obtuse*. This consideration would doubtless modify the former effect to some extent, but I consider the first would predominate in a vast degree.

In considering the effect of gravity *under the surface*, or perhaps I should say, within the circumference of the earth, I will first mention that if we were to apply roughly to it the deduction from the former theory as regards distance, viz., that the nearest $\frac{1}{60}$th part exerts more, or as much power as the remaining $\frac{59}{60}$th, it would at once furnish us with an item sufficiently large to account for the discrepancy between the real and the calculated duty of the mining engine: say the sixtieth part of the earth's diameter is about 120 miles, then, according to the theory, the first 120 miles exerts one-half of the attractive power of the whole earth, but the first 120 miles is likewise subject to the same law, and by applying the rule to it we find that the first sixtieth part, or two miles, exerts one-half of the attractive power of the 120, and consequently one-fourth of the power of the whole earth: apply the rule again to the two miles, and it would give that the first 60 yards (or, as I said before, 100) exerts one-half of the power of the two miles, one-fourth of the 120 miles, and one-eighth of the attraction of the whole earth. If, therefore, we could say at once that a substance 60 or 100 yards below the surface loses *one-eighth* of its weight, or at 300 yards loses a *sixth*, it would furnish the item required. This could only be done by the earth *above* neutralizing the same bulk of earth *below*, thereby diminishing vastly the *energy* of the sensible attraction by placing it at *greater* distance: and in stating my ideas on this point, I propose to simplify the subject by representing or supposing the attractive power of each quarter of the earth (or each angle of 90°) as being accumulated to a line or arrow in the centre of each angle. Suppose a bulk of iron in the centre of the earth, (see fig. 3,) each angle of 90° would act with equal energy, and the whole

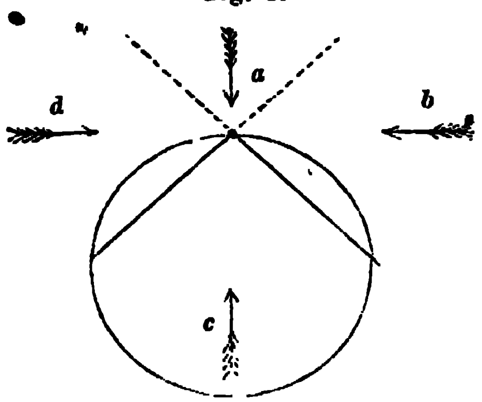
Fig. 3.




attractive power of each angle may be supposed to be concentrated at the arrows

*a, b, c, d,* which are each endeavouring to attract the iron from the centre with equal force in *opposite* directions, and, as I said before, the forces each way being equal, the iron would be *destitute of weight.* Now suppose the iron to be placed on the surface of the earth, (see fig. 4,) the attraction from the four arrows would be as shown; *d* and *b* exert jointly a small amount of power towards the centre, the attractive power

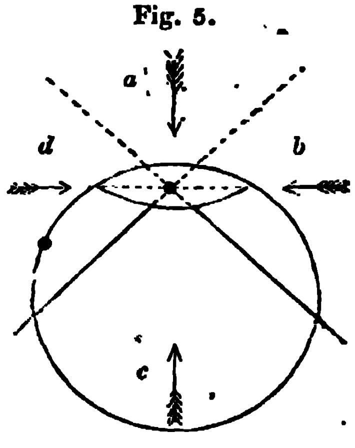
Fig. 4.




of *c* is nearly that of the whole earth; *a* has no power at all; therefore *c* exerts an immense sensible attraction, or *causes* the iron to have (as we popularly term it) *great weight.*

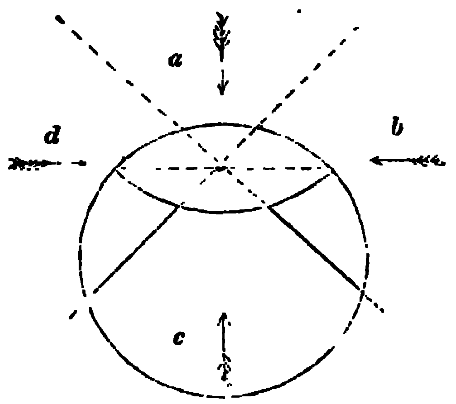
But the case is much altered when the iron is within the circumference; (see fig. 5,) *c* will still exert the sensible attraction, but it is apparent that the most energetic portion of the attractive power (*i. e.* the nearest) must and will

Fig. 5.




be neutralized by the opposite attraction of *a*, residing in that portion of the earth above the horizontal line; this will necessarily subtract from the *quantity* of available power by subtracting from the entire bulk of the earth; it will likewise much detract from the *energy* of the available power by placing the *commencement* of that power at greater distance from the object, and the *centre* of available attraction will have receded in a still greater degree. By again advancing the iron to twice the distance from the circumference, (see fig. 6) it will leave *more* than double the bulk of earth behind to counteract the sensible attrac-

Fig. 6.




tion; it will throw the *commencement* of sensible attraction to twice the former distance, and the *centre* of sensible attraction to *more* than twice the distance,—thus detracting vastly from its *energy*,—and likewise will have decreased the remaining attractive bulk of the earth by the amount it has taken from it or neutralised. It will be very apparent that all these considerations will act with increased effect if the earth should in reality be *hollow*,—say, if it should have an outer crust of only 20 or 40 miles in thickness. However, perhaps the following proposition is more tangible. The *greatest* sensible attraction or weight being exerted at the surface, and the *least* at the centre of the earth; and this weight or sensible attraction being the principle which draws the particles of bodies into close contact with each other, or makes them *dense*, it is fair to suppose that the density of the earth must *decrease* towards the centre, or the particles not be drawn so closely together from *lack* of this principle of weight; and this decrease of density may, as far as regards power of attraction, be called a certain degree of hollowness, and would be tantamount in *effect* to it. But this effect, again, may be modified by heat and fluidity, which again may be modified by another very important consideration, which is,—“Can gravitation exert its

power as *freely* through matter as through space?" Suppose a lump of iron placed 8,000 miles above us in space, the British isles, as part of the earth, shall attract it directly, with a certain force, say 5; then again, place the iron 8,000 miles in an opposite direction, it will be somewhere near Van Dieman's Land: *query*, will the British isles, exerting their attractive power through the entire bulk of the earth, still attract the same bulk of iron with the same force of 5; the distance in both cases being equal?

However, all these considerations and ideas are valueless as regards the applicability of the principle to the pumping engine, unless it should be *proved* by experiment that it has a very perceptible value at the depth of the Cornish mines. These experiments are not at all in my way; and I can only suggest to such of your friends as may feel inclined to undertake them, one or two plans by which I conceive they may arrive at a correct conclusion; and I will take the liberty of recommending the subject to Mr. Adcock, in whose able hands I consider the subject would be fully tested; and it might possibly solve a thing which I believe rather puzzled him a short time back; viz., he had fitted a spray pump to some mine, and it threw up a *much larger* quantity of water than he had *calculated* it would do. The principle is applicable to his spray pump equally with the lift pump. I have also good reasons for thinking it would satisfactorily explain why they cannot sound at sea beyond a certain depth, but with which I will not trouble you. To return to the experiments: I think they should not be tried under the shaft, but at some distance in the interior of the mine, to have the full benefit of the mass of earth above; and it will, of course, be useless to use scales and weights, as the weight being acted on *equally* with the substance weighed, the *specific gravities* would, I presume, remain the same. A man, however, ought to be able to lift a larger bulk of any substance, or appear *stronger* at the *bottom of the mine than on the surface of the earth. A steel spring also*, capable of throwing a weight a certain height on the surface, should throw it *higher* at the bottom of the mine. But I think the most ready and simple means will be the common dial-faced weighing machine, acting by means of a *spring*. Weigh with it a quantity of ore at the bottom of the mine, or fill a small cask or keg with water, and weigh that accurately; then take it to the surface and weigh it again there. Should there be no difference, of course the preceding observations are all moonshine as far as regards the power of the pumping engine. Should, however, there really *be* a difference, it will be interesting to know the ratio of diminution of weight at different depths, and which I believe can be easily ascertained in different chambers of the mine. As the apparatus for determining this question would be of no expense, and the experiment so simple, that any intelligent mining agent or foreman can undertake it, I hope speedily to see some information on the subject in your columns. Many persons, as a matter of course, will ridicule these out-of-the-way ideas altogether; but there is one comfort, (such as it is) which is, that many acknowledged clever men have subjected themselves to the same thing in their attempts to explain this *mysterious agent*, this *percussive oddity*, this *incalculable curiosity*. Singular, that a steam-engine, employed for mining purposes, should do more work than a steam-engine employed in any other way! However, I consider the only hope of arriving at a solution of the difficulty will be, for each person to whom a new idea occurs, to place it before the public, with his reasons, &c., and it is probable some one will at length hit on the right. This, at least, is the apology I offer for troubling you to so great a length. I decline putting my name to this, but send you part of a card; should my suggestions prove correct, I shall probably send you the remainder. At present I subscribe myself,

Your very obedient servant,

MERCURY.

P.S. I am not aware if the experiment with the spring weighing machine *has ever been tried in a balloon; if not, I would recommend it to some of your* aëronautic friends. The same experiment might be tried in deep ocean, which would require great care; the

deep sea lead must be attached to the weighing machine; and I suggest to put a coat of soft grease on the dial-face, and to fix a piece of thin wire on the hand to mark the grease as the hand traversed. It must be lowered very slowly, else the resistance of the water to the lead would falsify the experiment. Query,—Can your friend Nauticus inform me if there has ever been an attempt to sound the ocean, using metal wire for the lead line? And, if so, whether they were enabled to sound to a greater depth with wire than with rope? Likewise, what is the reason generally assigned for only being able to sound a certain depth? If I am imposing too much on him, I must plead as apology, that from his *cognomen*, I thought him more likely to know about these matters than most of your correspondents.

### SOLUTION OF THE FIRST "CAMBRIDGE MATHEMATICAL QUESTION."

Sir,—The given equations should be $x + y + xy = a$, and $\overline{x^2+y^2} \times xy = 6$, instead of $4 + y + xy = a$, and $\overline{x^2+y^2} \times zy = 6$. This premised, we have $x + y = a - xy$. .. (1), and $x^2 + y^2 = \frac{6}{xy}$ ...... (2), squaring (1) $x^2 + 2xy + y^2 = a^2; -2axy + x^2y^2$; substituting (2) from this, $2xy = a^2 - 2axy + x^2y^2 - \frac{6}{xy}$; dividing by, 6 $\frac{2}{6}xy = \frac{a^2}{6} - \frac{2a}{6}xy + \frac{1}{6}x^2y^2 - xy$; and by transposition, $\frac{1}{6}x^2y^2 + \left(\frac{2a}{6} + \frac{2}{6} - 1\right) xy = \frac{}{6}$; or, $x^2y^2 + \left\{\frac{\frac{2a}{6} + \frac{2}{6} - 1}{\frac{1}{6}}\right\} xy = \left(\frac{a^2}{6} \div \frac{1}{6}\right)$, a quadratic from the solution of which, suppose we get $xy = q$, then $x + y = (a - q)$, from which equations we readily find $x = \frac{(a-q) + \sqrt{(a-q)^2 - 4q}}{2}$, and $y = \frac{(a-q) - \sqrt{(a-q)^2 - 4q}}{2}$ as required. Sir, I remain, yours, &c.

THOMAS GREENUP, JUN.

Alnwick, Northumberland, March 6, 1841.

[This paper, which has been long standing over for want of room, was accompanied by a very ingenious solution of Kinclaven's geometrical theorem—of which, however, a solution was given in our 920th number, by Mr. Scott.—ED. M. M.

### MECHANICAL PROBLEM.

Sir,—Being lately employed in making a tea-caddy, or tea-chest, whose length, breadth and depth were equal to each other, I applied to a cabinet maker for some mahogany veneering with which to cover it; and he gave me two square veneers, each containing the same surface as three of the equal sides of the chest. By reason of the assistance obtained from the venerable Euclid, I succeeded in dividing each of the two given squares into three other equal squares, without wasting any more of the wood than was made by the teeth of the saw. If any of your ingenious correspondents will furnish a simpler solution than the following, they will greatly oblige, Sir, your

Well wisher, and constant reader,

E. E., AN OLD CARPENTER.

Normanby, Burton-on-Stather, Lincolnshire, August 13, 1840.

*Solution.*

Let A B U W be one of the given squares. On A B describe a semicircle A C B, make B H = ⅓ A B, and erect the perpendicular H C, meeting the circumference in C. Join C B, C A. On B C describe the square C E, and on A C describe the square C T. Join

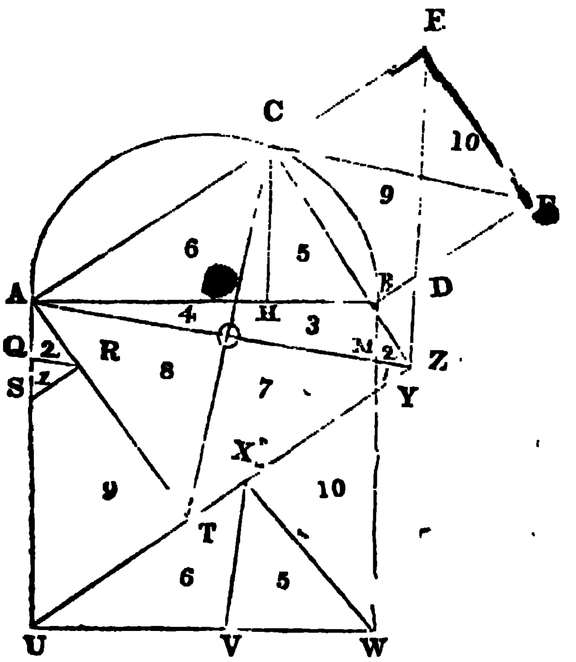
T U, E Z, C T, A Z, and from W demit the perp. W X. Also from X, draw X V, parallel to C T. Lastly, make $\triangle ARQ = \triangle BZM$, and $\triangle QRS = \triangle MZY$, and the square A W will be divided as was required, viz.: into two squares, on A C and B C, or into three squares, the square on B C and figs. 2 and 3.

The figures 1, 2, 3, 4, &c. in the triangles and trapezoids are for more speedy reference.

*Demonstration.*

The $\angle ACB$, being in a semicircle is a right angle (Euc. B. 3. Pr. 31.); therefore (Theo. 47, B. 1st.) the squares on A C and B C, are together equal to the square on A B. And (B. 6, Prop. 8th, Cor. and construct,) $AB \times BH = BW \times BH = \frac{1}{2}\overline{AB}^2$; and for the same reason $AB \times AH = AU \times AH = \overline{AC}^2 = \frac{1}{2}\overline{AB}^2 = \overline{2BC}^2 = \overline{CE}^2$; $\therefore AC = CE = CZ$, and $BC = CO = AO = ZO = TO$. Wherefore the diagonals A Z, C T, C E, divide the two squares on A C and B C into six equal and similar right angled triangles, or half squares, making three equal squares (Euc. 1, 34). We have therefore, now only to prove that the several figures of which the square on A B is composed, and which are not common to both the squares on A C and A B, are in every way equal to the remaining figures which complete the squares on A C and B C.

Fig. 1.




In the triangles U A T, A C B, $\angle UAT = \angle BAC$, being each the compt.

Fig. 2.

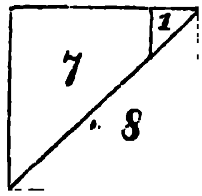
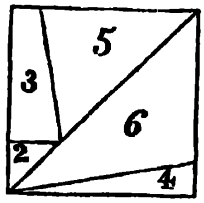


Fig. 3.



of $\angle BAT$ to a right angle, and $AC = AT$; also $AB = AU$, therefore the triangles U A T, A C B are equal (B. 1, Prop. 4) and $\angle ACB = \angle ATU = \angle ATZ = ZCF$, wherefore Z T U, and A C F are continued straight lines. Again, because $BC = UT = CF$ and $AF =$ and $\parallel$ to U Z, the $\triangle CFZ = \triangle TUA$, and $FZ =$ and $\parallel$ to A U and B W. (Euc. 1, 38) $\therefore$ B D Z Y is a parallelogram and $\triangle BYZ = \triangle BZD$. By construction $\triangle ARS = \triangle BZY$, or B Z D and $\triangle AQR = \triangle BMZ$, also $\triangle QRS = \triangle MZY$. From $\triangle AUT$ take away $\triangle ARS$, and from $\triangle ZCF$ take $\triangle BZD$, and the remaining trap. S R U T = trap. B D C F. It has been proved that $FZ = AU = BW$, and $BY = DZ$, $\therefore FD = YW$. And the right-angled triangles W X Y, F E D, having their vertical angles W Y X, F D E equal, are equal in every respect Euc. 1, 26); conseq. $FE = WX$ B C. Moreover $UW = AB$, and $\angle UXW = \angle ACB$, being each a right angle $\therefore$ (ibid.) $\triangle UXW = \triangle ABC$, and $UX = AC$. And because X V is $\parallel$ to C P, and A C $\parallel$ to U X, $\angle ACP = \angle XUV$, also $\angle CAB = \angle XUV$, $\therefore \triangle ACP = \triangle UXV$, and the remaining $\triangle PCB$ = remaining $\triangle VXW$.

Q. E. D.

## WILLIAM SYMINGTON, THE INVENTOR OF STEAM NAVIGATION.

Sir,—With mingled feelings of admiration and gratitude, the family of the late William Symington have perused the masterly article in the last Number of your Journal, on his claim to the invention of Steam Navigation. Admiration for the able manner you have advocated his cause—gratitude for the sympathy expressed for his misfortunes.

The flood of light you have let in upon Fulton and his pretensions has completely exposed the paltry motives which must have influenced him, and left to his supporters no cause to rejoice in the excessive laudations with which they have been pleased to honour him. Taylor's schemes of deception you have given to the winds,

and Chambers, his "rabid partisan," stands forth in his proper colours.

Concerning Fulton, it would seem as though the thoughts of arrogating to himself the honour of inventing Steam Navigation occurred to him, and grew in strength, as success promised to attend his experiments, for I have it from good authority that after he had seen Mr. Symington in Scotland, he not only mentioned having seen his Steam Boat, but also showed some drawings explanatory of her construction. This I had from a friend of mine, who called upon an eminent American engineer, (Mr. J. Perkins,) in the year 1829, and showed him the drawings of Mr. Symington's boats; he no sooner saw them than he said, "I saw similar drawings many years ago, in the possession of Mr. Fulton, in America, whilst he was engaged with his Steam Boat; and he told me he had got, or taken them, from a gentleman's boat in Scotland." After the publication of my pamphlet, I called upon that individual, presented him with a copy, and inquired if he remembered having had such a conversation. On looking at the drawing, he at once said, "I have seen drawings like these in the possession of Mr. Fulton, and always understood that he got the information from a gentleman of that name, (Symington,) which enabled him to succeed." I called again, by his own appointment, either next day, or a few days afterwards, to receive a letter to that effect, but instead of meeting with him, saw his son, who handed me the promised letter, containing all the circumstances which his father's memory could permit him to recollect; that letter is still in my possession.

As to Mr. Miller, there can be no objection to award to Mr. Miller the credit of having patronized the invention, and afforded, to a considerable extent, the means of bringing it into notice; but whatever sums he may have expended in his schemes of improving naval architecture, or artillery, the mere Steam Boat experiments cost him nothing in comparison to what they cost Mr. Symington and Mr. Meason; I may refer on this head, to page 90, of your 561st Number, May 10, 1834, where a letter, addressed to the editor of the *Caledonian Mercury*, in September 1827, by Mr. Symington, is quoted, in which he says:—

"I admit that Miller furnished the boat, and defrayed the price of the machinery, at this time, (1788,) and also of the second experiment, at Carron, in 1789, but I decidedly and positively refuse that Mr. Miller ever remunerated me, in any way, for my personal trouble and expense; in fact, the experiments cost me more expense than they did Mr. Miller, to say nothing of my anxiety and devotion, to carry them into full effect."

In another part of the same letter he states:—

"It is not true that I had pecuniary difficulties to struggle with, while making the experiments on Mr. Miller's boat, for during all that time I was in the service of the opulent Wanlock Head Mining Company."

The amount of the accounts paid by Mr. Miller to the Carron Company was only £363 10*s.* 10*d.*; an insignificant sum to effect so mighty a purpose.

As to Taylor, I have repeatedly stated, and the College Album of Edinburgh will make good my statement, that it was in 1786 Mr. Symington had the conversation with Mr. Miller, in the house of Mr. Meason, where he proposed the use of the steam-engine in navigation, and showed Mr. Miller, by means of the model of the steam-carriage, how it could be accomplished. How is this reconcileable with the idea having occurred to Taylor after a certain boat-race, which took place in February, 1787: and after, even subsequently to that race, having in company with Mr. Miller "beat over the whole system of mechanics." Clearly, not at all. Possibility, as well as probability, is against the Tutor.

As to Mr. Robert Chambers, the following facts will speak for themselves:— In March, 1833, Mr. C. publicly pledges himself, in his Journal, to prove, from documents in his possession, that to James Taylor the world was indebted for that wonderful fabric, the steam-boat; yet, when called upon to do so, he maintained an obstinate silence, until a proposal of rather a startling nature, from Mr. William Symington, produced a letter from Mr. Robert Chambers to Mr. William Symington, in which he says, "I have *always* considered your father to be an estimable person." A pretty admission, truly, seeing that in the article complained of he had described him as secretly stealing Mr. Taylor's invention, and taking out a patent to secure it to himself. If such conduct rendered Mr. Symington estimable in the eyes of Mr. Chambers, it may account for his representing Mr. Miller, after having praised him to the uttermost, as influenced "by the most innocent of all vanities," in

seeking to appropriate to himself the property of another—Taylor's invention of steam navigation; and for his partiality to Taylor, in that he was a fac-simile of Mr. Miller in habits and disposition—a similarity existing, it is to be hoped, more in imagination than in reality.

Assuring you of the readiness of every member of Mr. Symington's family to meet the judicious test you have proposed, courting the strictest investigation, and prepared to substantiate my various statements, I remain, Sir,

Your most obedient servant,
ROBERT BOWIE.

Burr-street, August 18, 1841.

P.S.—You will perceive by a letter in the "National Advertiser," addressed by me to its editor, that there were *four* steam-boats used by Mr. Symington in his experiments—two for Mr. Miller, in 1788 and 1789; and two for Lord Dundas, in 1801, 2, and 3. The two for Lord Dundas bore the name of the "Charlotte Dundas," and have inadvertently been described as one, owing to the first being merely a preparatory boat, to arrive at the best mode of arranging and trying the power of the machinery.

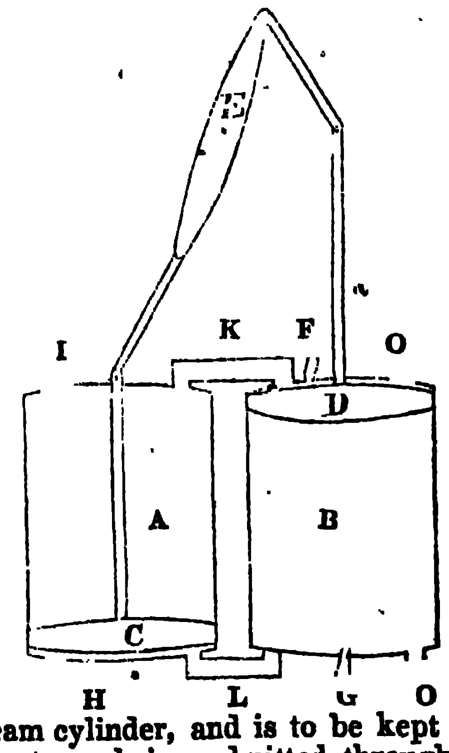
[We are happy to learn, from several other communications we have received, that our appeal to the public on behalf of Mr. Bowie's distinguished relative has not been without its good effect; and probably requires only to be energetically followed up, to produce a National Testimonial in every way worthy of the occasion. One gentleman desires to have his name put down to any subscription which may be set on foot for 10*l.* 10*s.*; a second, for 5*l.* 5*s.*; a third, for 3*l.* 3*s.*; and a fourth, for 10*l.* 10*s.*; while our much-valued correspondent "Scalpel" has sent us a letter in support and furtherance of our views, (the insertion of which, however, we are obliged, from want of room, to defer till our next,) worth a good many golden subscriptions. As soon as a committee is formed to take the management of the subscription—which we hope will be ere many days—we shall be glad to hand over to them the names of the above gentlemen, as well as those of any others who may be pleased to make us the medium of similar free-will offerings to the memory of one of the greatest benefactors of our country and of mankind.—Ed. M. M.]

## PILBROW'S CONDENSING CYLINDER ENGINE.

Sir,—In your last number there is a letter from Mr. Pilbrow, the inventor of the "Patent Condensing Cylinder Engine," in which he invites discussion on his invention, justly observing, that thereby, if the invention have merit, a service will be rendered to science in establishing its claims; and, on the other hand, should it be shown to be worthless, a service would be done to him in preventing him from throwing away his time and money on what cannot repay him. In compliance with his request, I send you the following remarks on his engine, craving for them a place in your useful Magazine.

This engine is described in No. 930, vol. xxxiv. of your Magazine. The writer of the article, Mr. Boyman, assumes certain data, and reasoning therefrom, arrives at this somewhat startling conclusion: "This is increasing the duty of the *best* engines under the *best* circumstances very nearly THREE times, so that a passage to America, which now requires 600 tons of coal, will, with this engine, require but little more than 200." (p. 420.) As many of your readers may not have at hand the number of your Magazine referred to, and also in order to illustrate this communication, it may be useful to give here a short description of the engine and its mode of operation. A and B, fig. 1, are two cylinders, equal in size, placed side by side. A is the

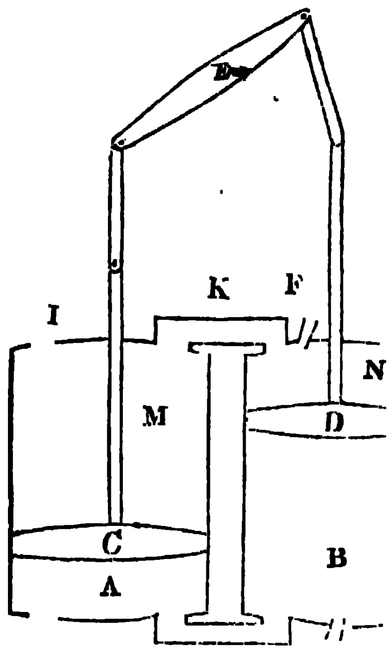
Fig. 1.




steam cylinder, and is to be kept hot, the steam being admitted through the

apertures H and I, while B is the condensing cylinder, and is to be kept as cold as possible, the injection water being admitted through the openings F and G. There is a communication K between the top of A and the top of B, to permit the free passage of steam to be condensed, and the same L at bottom. The pistons C and D, are connected together by means of the beam E. Fig. 2 is the same as fig. 1, only the pistons are in a different position.

Fig. 2.




Its operation is as follows:—In the cylinder B, suppose a vacuum under the piston, and the cylinder A to be full of steam, but the communication between the top of A and the top of B is open, so that the steam in A will not prevent the rising of the piston C: for the other piston D will descend as C rises, and the steam will flow from A into B, and will be there condensed, by the injection water from F. In this state the engine is ready to make a stroke. Let steam from the boiler be admitted into A under the piston C, and, as there is a vacuum in B, the piston will rise with the full force of the steam. The stroke being completed, the piston C will be at the top of A, now full of steam, and the piston D will be at the bottom of B, having a vacuum above it, arising from the condensement of the steam used in the previous stroke. The engine is now ready for another stroke, but as this is performed in the same manner as the last, merely reversing the action of the pistons, farther explanation is needless.

The difference between the common condensing, and this engine, will now be obvious. In the usual engine, the vacuum is not got all at once, but is obtained gradually while the steam is being condensed, the loss of power thereby being 3½ to 4 lbs. on each square inch of the piston: while in this engine the vacuum being obtained during the previous stroke, the piston has throughout its entire working stroke a vacuum equal to that with which the usual engine ends its stroke: and so, (Boyman *loquitur*) a clear gain of 4 lbs. per square inch of the piston is obtained.

The loss of 4 lbs. per square inch in the common engine, arises from two causes; first, from the slowness, or rather the progressive condensation. The amount of this loss is indicated by the barometer attached to the condenser, which, on the admission of the steam, suddenly falls, then nearly as suddenly rises, but not to the same height as before, which height it gradually reaches before the stroke is concluded. As the slowness of condensation does not affect Mr. Pilbrow's engine, the loss in the common engine, as indicated by the fluctuation of the mercury in the barometer, must be given in its favour. The second cause, by far the most important, is the difference between the vacuums in the condenser and in the cylinder, which is found by comparing the cylinder indicator with the condenser barometer. The amount of loss arising from this cause cannot be given in favour of Mr. Pilbrow's engine, for his engine is as much affected by it as any other. This will be evident when it is considered that the full power of the engine, arising from the pressure of the steam in A, fig. 2, under the piston C, and the vacuum in B, under the piston D, can be given out only on the condition of an equilibrium between the upper sides of the pistons; or, in other words, that the exhaustion in the steam cylinder at M, and in the condensing cylinder at N, be the same. If the steam presses with more force on the upper part of C than on the upper part of D, the difference, whatever it may be, is a dead loss, and must be deducted from the power of the stroke

*then* being made. The difference of exhaustion between the cylinder and condenser is always considerable, nor can it be reduced to nothing. It seems inherent, in the circumstances under which condensation is always effected, viz., by opening a communication between a hot and a cold chamber. No doubt, in this engine, the difference may be lessened, by making the steam passage capacious; and this may be done till the valve becomes inconveniently large, yet the difference will still be great. Farther, in the common engine, the piston *pursues* the steam, which, in the rotatory kind, has hardly time to get away from it, and part of the loss of power may be ascribed to this cause—which is doubled in this engine—the steam piston pursuing the steam, while the condensing cylinder piston *flies* from the vacuum; and, as the motion of a piston is always swift, the loss may not be imaginary. On the whole, it is evident that the gain of power by the plan of condensing, during the previous stroke, is greatly overrated.

A farther gain is claimed for this engine, on the ground that, by dispensing with the usual pump and condenser, "the condenser piston acts as a double action air-pump, and expels every evacuation of the cylinder at each up and down stroke. In the usual engine, the air-pump being single, permits the accumulation of two condensements in the condenser to resist the action of the piston. Though, therefore, the condenser piston (in this engine) will always have on its other side the condensement of the previous stroke at 96° or 100°, and that small portion of air and gas disengaged from one condensement, yet it cannot have the same accumulation of air and gas which exists in the usual condenser, and which gives a greater resistance than is due to the temperature alone. The gain from this cause may be considered as 1 lb. on the square inch."—p. 418.

The manner of expelling the condensement will be understood by referring to fig. 2. The steam from the boiler is supposed to be flowing into the steam cylinder, through the passage I, and pressing down the piston C, while the piston D rises in the vacuum in N, obtained during the previous stroke, having the condensement lying on its upper side. When the piston arrives near the top of the cylinder, the condensement (says Mr. Boyman) raises the valve at O, and the piston continuing to rise, it is forced out, and escapes into the hot well. But there is an important circumstance which seems to have been overlooked here. The clear space in the cylinder must be somewhat longer than the stroke, to prevent all risk of the piston striking the top or bottom of the cylinder. Mr. Watt allowed, in the Albion Mills (8-feet stroke,) no less than seven inches, four at the top, and three at the bottom. Now, it is manifest that, after the condensing piston D (fig. 2) has ejected all it can—has finished its stroke, and risen as near to the top of the cylinder as it can go, this space at the top, together with the steam and eduction passages, will remain filled with both hot water, and air and other gases, having a density somewhat greater than the surrounding atmosphere. This quantity, probably, cannot be reduced, with safety to the engine, to less than two condensements, which, added to that arising from condensing the steam in the previous stroke, will amount to three entire condensements in the condensing cylinder, during the whole working stroke. Instead, then, of considering this plan as better than Watt's, it must be regarded as greatly inferior, and as entailing on the engine a considerable loss. But the plan is liable to practical as well as theoretical objections. The water with which the upper side of the piston is loaded comes against the top of the cylinder with a crash, (causing much strain,) and flings open the valve, and that instant the whole weight of the atmosphere rests on the piston; in consequence of which the engine is not only deprived of all its power, but an enormous additional burden is thrown on it, and, were it not for the energy of the moving parts, it would come to a stand-still.

The friction, also, is greatly increased in this engine, arising from the condensing cylinder, piston, extra valves, connecting beam, &c. And now to conclude. Balancing the gain and loss, it appears to me that the engine, so far from having the advantages ascribed to it, is in reality inferior to those in common use.

I am, Sir, your very obedient servant,

W. M.

Hoxton, Aug. 12, 1841.

## CLYDE-BUILT STEAMERS.

Sir,—In your last week's Magazine, I saw a letter signed A. M., and as I am able at once to answer some of his inquiries, from facts which it is possible "Nauticus" may not be in possession of, I take the liberty of addressing you. In the first place I would observe, in reference to the *Grand Turk*, that so far from her having given "more satisfaction than any," she has been a constant expense to her owners; in fact, I have no hesitation in saying that, compared with a similar boat, (*The City of Boulogne*,) built in London about twelve months after the *Turk*, her expenses, as regards consumption of fuel, wear and tear of both vessels and engines, have been at least four times greater than the vessel referred to. However, I am collecting some further facts, which I shall forward you as early as possible, in reference to this particular vessel, as she appears to be cited as a specimen of Clyde ship-building. I further beg to observe, in reference to that part of A. M.'s communication, where he wishes "Nauticus" to divest himself of prejudice, and tell him the real speed of these vessels, that the following may be relied on as substantially correct.

The *William Wallace* was tried in the Thames on Saturday last, when she started from Deptford against tide with the *Duchess of Kent*, the *Duchess* having on board about 300 passengers, her dimensions being about as follows: length, 170 feet; beam, 22 feet 6 inches, drawing 7 feet water, and propelled by two 70-horse-power engines; the *Wallace* being 145 feet long, 19 feet beam, drawing only 5 feet water, and propelled by two 60-horse-power engines, and only her own people on board.*

The dimensions here given must show what great advantage the *Wallace* ought to have had over the *Duchess;* yet, strange to say, she hardly kept way with her to Gravesend; here the contest with the *Duchess* ended, the *Wallace* turning round to try her hand with the *Duke of Sussex*, a vessel of about her same length, but rather less beam, drawing about the same water, and propelled by two 40-horse engines; yet with this great difference of power the *Duke of Sussex* beat the *Wallace* by seven minutes to Blackwall. A. M. will please to understand that neither the *Duchess of Kent* nor *Duke of Sussex* are more than third-rate boats on the Thames. Let him show us something that will compete with the *Blackwall*, or *Railway*, both in speed and consumption of fuel, and then we will give him rest, and not till then. There is one thing more I beg to observe, and I most seriously call the attention of the owners of the *Wallace* to the circumstance, that she is furnished with *accessible safety valves*, with weights to be added at pleasure by the engine driver. Now as we know from the evidence before a Committee of the House of Commons, that more accidents have arisen from this cause than any other, I beg to suggest an immediate alteration of that part of the *Wallace's* machinery.

Your obedient servant,

L. P.

August 5, 1841.

* I have said that the *Wallace* had only her own people on board; but, as I may be challenged with mis-statement I would inform you that she had about 15 tons of coals in her after-hold to bring her in trim: and allow me to ask how it is that nearly all the Scotch-built boats require some such complement to bring them to their proper lines? Surely there must be some bad calculating, either with engines or builder.

## ON THE PROPULSION OF VESSELS BY THE TRAPEZIUM PADDLE-WHEEL AND SCREW.

At the Plymouth meeting of the British Association, Mr. G. Rennie gave an account of the various experiments to which he had been led, on the propulsion of vessels by various forms of paddle-floats, and by the screw. It was generally admitted that the paddle-wheel was the best means of propulsion with which engineers were at present acquainted, and various attempts had been made for its improvement. There are several objections to the square or rectangular floats, particularly the shock on entering the water, and the drag against the motion of the wheel on the float quitting the water; both of which give rise to considerable vibrations. He had been led, in considering the improvement of the paddle-wheel, to have recourse to nature, and the form of the foot of the duck had particularly attracted his attention. The web of the duck's foot is shaped so that each part has a relation to the space through which it has to move, that is, to the distance from the centre of motion of the animal's leg. Hence he was led to cut off the angles of the rectangular floats, and he found that the resistance to the wheel through the water

was not diminished. Pursuing these observations and experiments, he was led to adopt a float of a trapezium or diamond shape, with its most pointed end downwards. These floats enter the water with their points downwards, and quit it with their points upwards, and then arrive gradually at their full horizontal action, without shocks or vibrations; and after their full horizontal action, quit the water without lifting it, or producing any sensible commotion behind. After a great variety of experiments, he found that a paddle wheel of one-half the width and weight, and with the trapezium floats, was as effective in propelling a vessel as a wheel of double the width and weight with the ordinary rectangular floats. The Admiralty had permitted him to fit her Majesty's steamship, *African*, with these wheels, and he had perfect confidence in the success of the experiment.

Another means of propulsion was the screw, which had been applied with success by Mr. Smith in the *Archimedes*. In examining the wings of birds and the tails of swift fish, he had been particularly struck with the adaptation of shape to the speed of the animals. The contrast between the shape of the tail of the codfish, a slow-moving fish and the tail of the mackerel, a rapid fish, was very remarkable, the latter going off much more rapidly to a point than the former. From these observations he was led to try a screw with four wings, of a shape somewhat similar to these, but bent into a conical surface, the outline being a logarithmic spiral. He found also that certain portions of these might be cut off without diminishing the effect. With respect to ascertaining the friction of the screw on the water, great difficulty existed; but he would refer to his experiments, published some years ago in the Philosophical Transactions, in which he measured the friction of the water against a body revolving in it, by the time which a given weight took to descend; this body consisted of rings, and he found that the friction or resistance through the water did not increase in proportion to the number of rings.

## ON THE CIRCUMSTANCES UNDER WHICH THE EXPLOSIONS OF STEAM BOILERS GENERALLY OCCUR, AND ON THE MEANS OF PREVENTING THEM. BY DR. SCHAFHAEUTL, OF MUNICH, ASSOC. INST. C.E.

In this communication it is assumed, that, perhaps not one-tenth of the recorded explosions of steam boilers can be correctly attributed to the overloading of the safety valve, or to the accumulation of too great a pressure of steam in the boiler. The author alludes to the degree of pressure which hollow vessels, even of glass, are capable of sustaining, if the pressure be applied gradually. He found, in repeating the experiments of Cagniard de la Tour, subjecting glass tubes of one or two inches in length, one-fourth part filled with water, hermetically sealed, and immersed in a bath of melted zinc, that they apparently sustained the immense pressure of four hundred atmospheres without bursting; but if the end of an iron rod was slightly pressed against the extremity of the tube, and the rod caused to vibrate longitudinally, by rubbing it with a leather glove covered with resin, the tube was invariably shattered to pieces.

Hence he concludes, that something more than the simple excess of pressure of steam in the boiler is necessary to cause an explosion; and that a slight vibratory motion alone, communicated suddenly, or at intervals, to the boiler itself, might cause an explosion. From the circumstance of safety valves having been generally found inefficient, he concludes that a force has operated at the instant it was generated in tearing the bottom or sides of the boiler, before it could act upon the safety valve.

From the sudden effect of this force, explosions have been ascribed to the presence of hydrogen, generated by the decomposition of water: but, independently of the difficulty of generating a large quantity of hydrogen in such a manner, it could neither burn nor explode without the presence of a certain quantity of free oxygen, or atmospheric air; and such an explosive mixture would not take fire, even if mixed with 0·7 of its own volume of steam.*

The ordinary mode of converting water into steam is by successively adding small portions of caloric to a relatively large body of liquid; but if the operation was reversed, and all the heat imparted to a given quantity of water in one unit of time, an explosive force would be developed at the same moment. For example, if a bar of iron be heated until it is coated with liquid slag, and is then laid upon a globule of water on an anvil, and struck with a hammer, the liquid slag communicates its caloric instantly to the water, becoming solid at the same time that the water is converted into vapour with a loud report. A similar occurrence may take place in a steam boiler when a quantity of water is thrown into contact with an overheated plate, either by a motion of the vessel, or from a portion of the in-

* See the author's experiments, *Mech. Mag.* vol. xxx., p. 144.

crustation formed on the bottom or sides becoming loosened. A sudden opening of the safety valve may, under certain circumstances, prove dangerous, or even any rapid increase of heat which would cause a violent excess of ebullition in the water.

An examination is then entered into of the respective powers of water and of steam, to transmit undulatory motion, and of their compressibility. According to Laplace, the conducting power of steam at four atmospheres, and 294·1° Far., is 1041·34511 feet per second, and that of water 6036·88 feet. The ratio of these different velocities is, therefore, as 1 : 4·5.

In cases of a sudden explosive development of steam, the principal action is directed against the bottom or the sides of the boiler, whence spreading itself through the water, it is finally transmitted through the stream to the safety valve: a wave created by an explosion, even at the surface of the water, would reach the bottom or the sides of the boiler, 4½ times sooner than it would affect the top of the steam chamber; but if it took place at the bottom, the time for the explosive wave to reach the safety valve would be the sum instead of the difference of both velocities. Although these relative periods of time may be considered as infinitely small, it is contended that there is sufficient delay (counting from the moment at which the plates begin to yield) to cause the rupture of the material which would otherwise have yielded by its own elasticity, had the time been greater, as all communication of motion is dependant only on time.

To illustrate the effect of the sudden development of an explosive force upon the plates of a boiler, the author gives the result of a series of experiments made by him upon iron wires, for the purpose of ascertaining the amount of elongation which took place before yielding under the sudden application of a given weight. The result was, that a wire which had resisted a tension of 22 cwt., when gradually applied, broke invariably, without any elongation, when the same force was suddenly applied by a falling body.

Similar experiments with railway bars showed that fibrous iron, which supported a gradual tension, broke by the sudden application of the same force; while close-grained iron, which was incapable of resisting the gradual strain, bore perfectly well that of sudden impact. These facts are worthy of consideration in the selection of iron for boiler plates, where the sudden action of the rending force is to be guarded against.

The details are then given of a series of experiments, illustrating in an ingenious model, by means of an explosive mixture of chlorate of potassa, the effects of explosions at different heights within a boiler.

A careful examination of the circumstances, and the results of his experiments, convinced the author that a simple mechanical arrangement, applicable to all boilers, might be introduced, so as to diminish the danger arising from the sudden development of an explosive force. He proposes to connect with the bottom of the boiler, by means of a pipe, an extra safety valve of a given area, loaded to five-sixths of the absolute cohesive force of the boiler plate. In the event of a sudden development of steam, the first shock would act upon the valve, and open it, which would have the effect of depriving the wave generated of its destructive force, and at the same time diminish the violence of the second shock from the top of the boiler, having permitted the escape of a portion of the water from the boiler.

The apparatus for conducting the experiments was presented with the communication.

Mr. Parkes stated, that he had been occupied for several years in collecting facts illustrative of the phenomena of steam boiler explosions. These disasters could not all be referred to one cause. A boiler might be too weak to sustain the pressure within it, and a rupture would be the necessary consequence. But though the simple elastic force of the steam might thus occasionally account for the rending of a boiler, that cause was insufficient to explain many well-known phenomena, such as the projection of an entire boiler from its seat, the separation of a boiler into two parts, the one remaining quiescent, the other being driven to a great distance, &c. He was of opinion that a very sudden development of force could alone have produced such effects.

Dr. Schafhaeutl had ingeniously shown that an explosive force generated under water would act upon the bottom of the boiler and burst it, before the safety valve could relieve the pressure. The Doctor deduced from Mr. Parkes' theory of "the Percussive Action of Steam," and his own experiments, that if, from any cause, such as the breaking up of a portion of crust adhering to the bottom of the boiler, a volume of steam of high elastic force was suddenly evolved, a rupture of the bottom would be the consequence, or, the boiler might be separated into two parts. Mr. Parkes coincided in this opinion, and cited several examples in support of it.

It appeared to him that a force different from, and greater than, the simple pressure

of the steam, was the principal agent. The Committee of the Franklin Institute, and others, who in their experiments had endeavoured to produce explosions of boilers, had very rarely succeeded, and the effects obtained fell far short of those which continually occurred by accident. It might be safely inferred from this fact, that the experimenters had not arrived at the true cause of the ruptures and projections of boilers, otherwise, the production of similar effects would not have been difficult.

Describing the sudden development of a volume of steam, from highly heated plates, which no practicable number of safety valves could discharge quickly enough to save a boiler from destruction, he instanced the effects produced by the breaking up of the scale in salt pans. Carbonate and sulphate of lime were separated from brine by evaporation, and adhered very firmly to heated surfaces. A crust of salt frequently formed upon this deposit; the cessation of ebullition (if the deposit occurred over the furnace) was the consequence, and the bottom of the pan became red hot. The manner in which the pan scale was disengaged, was to strike it with the edge of a heavy iron pricker, which allowed the brine to reach the plate; it was also frequently broken through by the expansion and bagging down of the plates, leaving the crust above like an arch. In such cases the plate was seen for an instant to be red hot, and immediately afterwards an immense column of brine was projected from the pan, the steam evidently being of a high momentary elasticity. Mr. Parkes had seen a yard square of scale thus burst, the whole surface of the plate being at a glowing red heat. Had the pan been closed like a steam boiler, he conceived that the blow of the steam on the roof, bottom, or sides, would have destroyed the vessel.

A thin copper salt pan at Mr. Parkes's works had a hole burst through its bottom by the sudden action of steam thus generated. The spot had no doubt been previously injured by heat. He conceived that similar phenomena might, and frequently did occur in steam boilers.

A theory had been adopted by many writers on the explosion of steam boilers, that red hot iron plates would generate less steam than plates at a less heat. This was founded on the experiments of Leidenfrost, Klaproth, and others, on the length of time requisite to evaporate a small globule of water in a red hot spoon. But there was no analogy between the condition of a hot spoon containing a drop of water, and that of a body of water and heated plates in boilers.

Steam of great force would instantly be produced from a thin sheet or wave of water, passing over hot plates, the molecular attraction of a drop falling a short distance upon a plate would be destroyed, and the whole be instantly converted into steam of a high momentary elasticity. The theory of the hot spoon experiment, as applied to boilers, had been demonstrated to be fallacious by Dr. Schafhaeutl, in a paper published in the *Mech. Mag.* vol. xxx., No. 799.

The explosion of several boilers had been attributed, and Mr. Parkes thought justly, to a wave of water washing over highly heated plates. He believed that the fatal accident to the "Union" steamer at Hull was so produced. The boilers of steam vessels were not at that period so well arranged as at present, for preventing the water from flowing to one side, and leaving a portion of the top of the flues dry with the fire beneath. Under such circumstances, the disaster which occurred would be inevitable, on the vessel's coming on an even keel. Mr. Parkes was not of opinion that it required the exposure of a large area of heated metal to effect the separation of a boiler and the projection of the upper half of it; as, in this case, it was the suddenness of the action, no number of safety valves could have deprived the steam of its instantaneous force, so as to have saved the boiler. The entire circumference of large boilers had been frequently divided as clean as a pair of shears would have accomplished the work. These phenomena were evidences of a force very suddenly exerted.

Sudden actions on the surfaces of boilers arose also from other causes than the heating of plates. During the inquiry into the causes of steam vessel accidents, he ascertained that of twenty-three explosions, nineteen occurred on the instant of starting the engines, or whilst the vessels were stationary; three only whilst the engines were at work; the greatest number took place at the moment of admitting the steam upon the piston. He attributed this effect to the steam's percussive force, which would be as much felt by the boiler as by the piston; if the boiler was weak, and distended by steam to nearly the bursting point, the shock would be sufficient to cause its rupture. Mr. Parkes then gave several instances of such occurrences.

In 1817 the boiler of a steam vessel at Norwich burst, and killed many persons. Previous to the accident, the boiler leaked in several places; the steam issued copiously from the safety valve, which was evidently very heavily loaded. The engine had scarcely made a revolution before the explosion

occurred. By applying the present state of our knowledge to these facts, he felt assured that the steam's impact on the piston had been the immediate cause of that accident.

In 1826 or 1827, Mr. Parkes witnessed the effects of an explosion, a few minutes after its occurrence, in the neighbourhood of his works, near Paris. The boiler was of wrought-iron, 6 feet long by about 2 feet 6 inches or 3 feet diameter. By his advice the owner had previously put in a new end, formed of one piece of hammered iron, and he was strongly dissuaded from overloading his engine, or using habitually such enormous pressures. The cylinder of the engine was horizontal, and was connected with the boiler by a short pipe and cock. The proprietor informed him, that finding his machinery working too slowly, he went into the engine-house and stopped the engine. He held down the lever of the safety-valve, and on turning the cock to start the engine, the explosion instantly occurred. The new end of the boiler, which was opposite to the engine, was found separated from the body, and lying in the flue. The line of rivets, and a complete ring of the new end, remained upon the body, apparently little forced, and the faces of the fractured ends were as sharp and clean as if cut by a chisel or shears. The boiler, engine, and masonry were driven into the yard in the opposite direction to the escape of the water and steam; thus, though the entire end of the boiler was removed, and the whole contents evacuated, it acted too late as a safety-valve.

He observed similar effects last year, in an explosion at Camden-town, being fortunately on the ground to investigate it before much change had been made. Two boilers were set end to end, with a chimney between them. The end of one was blown out, and was lying close to its original seat. It was forced backwards into the chimney, which it partly supported on a pipe flange, and pushed the other boiler and entire masonry, in a horizontal direction, fully two feet. He considered that the percussion of the steam, from its re-action against the opposite ends of the boiler, in the act of tearing it off, (which was the effect in this case,) produced the recoil. In this case there were upon the boilers, (which were connected together,) two safety-valves in good order, and not heavily loaded. The accident occurred during the breakfast-hour, whilst the engines were not at work. One of the two stays which originally held the fractured end of the boiler was found to have been previously broken, as its separated ends were covered with old lime scale—the other had evidently been long cracked, and was only held by a fragment. The fractured end of the boiler was not exposed to the fire, nor did the shell or the flue within it exhibit any marks of injury from fire, or from dislodgement of scale. The steam, in its effort to escape, acting first against one end, not only raised the boiler from its horizontal position to an angle of about 45°, but gave it a twist obliquely from the line of its bed.

Mr. Parkes could not agree in the often expressed opinion, that what are called high-pressure steam boilers were more dangerous, or more liable to explode, than others. Much depended on care and management. He believed that he was in possession of accounts of nearly all the explosions which had occurred in Cornwall since the expiration of Mr. Watt's patent, when higher pressures began to be used, and they amounted only to five or six instances, exclusive of some cases of collapsed flues. More explosions had occurred in a small district round Wednesbury, during the present year, with low-pressure boilers, than in Cornwall in forty years, where the highest pressures were employed. He believed also that the coal districts of Northumberland, Durham, and Staffordshire, would furnish more cases of these disasters, from boilers both of high and low pressure, than all the rest of England put together.

When the practice in the coal districts was contrasted with that of Cornwall, the explanation was simple. Where coal was so cheap, the quantity used was unlimited, the negligence was great, and the allowance of boiler was small for any given sized engine, as enough steam could be raised by fires of greater intensity—the rule there being, to save in the first cost of the boiler; in Cornwall, on the contrary, the object was to insure economy in the consumption of fuel; consequently, all that class of accidents arising from injury to plates by fire and deposit, would be in about the ratio of the intensity of the combustion.

Notwithstanding the bad practice generally prevailing in the coal districts, there were some exceptions. At an iron work near Dudley, there were boilers now in good order, after nearly thirty years' use, having required but trifling repairs during that period. In those boilers, the plates of the bottoms which were exposed to the fire were all made of hammered, not of rolled iron—the boilers were large for their work, and were cleaned thoroughly every week.

Tilted plates were alone used for salt pans in those parts where the heat was most intense. Though continually heated to redness, and distorted by the action of the fire, the quality of the iron in plates thus formed did not appear to be deteriorated, for when taken out the smiths used them for making rivets, nails, &c. Rolled iron plates would

do for making coarse salt, which required a heat below ebullition, but they were quickly injured when used for fine salt, and were useless when taken out.

Mr. Parkes then adverted to several other remarkable cases of explosion. It was a well-authenticated fact, that a boiler belonging to Messrs. Ferey, at Essonne, in France, exploded on the instant of opening the safety-valve.

Three successive reports were heard when Steele's steam-boat boilers exploded at Lyons, indicating that they did not burst at the same instant. Now, though Mr. Steele had fastened down the safety-valve to increase the pressure of the steam, yet the explosion of the first boiler should, according to the received opinions, have acted as a safety-valve to the second and third, and have saved them—*for*, by the destruction of the first boiler, the pipes would be broken, and a free exit be afforded for the steam in the others; nevertheless, they all three burst in succession. Several similar instances of successive explosions had occurred in England. He would not at present enter upon an explanation of what he considered might have occasioned these phenomena; but he would express his conviction, that the practice of suddenly opening and closing the safety-valves was extremely dangerous. To be useful as escape-valves, they should be allowed to open and close in obedience to the steam's pressure only, not to be handled more than was absolutely necessary.

None of the theories yet advanced appeared clearly explanatory of the cause of the projection of heavy boilers from their seats, when in many cases they contained abundance of water. He instanced a case in which a boiler exploded, and carried to some distance a boiler connected with it, and in which some men were at work. The boilers separated while in the air, and the one which exploded attained a very considerable height, although it was 28 feet long by 6 feet diameter. The particulars of this explosion were furnished to him by Mr. Clarke, engineer to the Earl of Durham, but they could not be properly appreciated or explained without the drawings and description.

A boiler weighing about 2½ tons was projected from its seat at Messrs. Henderson's woollen factory, at Durham, in 1835; it ascended to a considerable height, and fell 300 yards from the place where it had been seated.

A cylindrical boiler exploded at the Crenver Mine, in Cornwall, in 1812. It passed through the boiler-house, and opened itself in the yard outside, where it was described to have fallen "as flat as a piece of paper."

Facts of this nature were replete with interest, and should lead engineers to the consideration of causes and remedies.

Mr. Parkes then instanced several cases of boilers which had become red hot, and had not exploded; one example was a set of three boilers, the tops as well as the bottoms of which were red hot, in consequence of the house in which they were fixed being on fire; yet they did not explode. No water had, however, been pumped into the boilers whilst so heated.

He was in possession also of several curious examples of ruptures and projections of vessels arising from causes very different to the foregoing. One case occurred in February, 1837, at the works of Messrs. Samuel Stocks and Son, in the township of Heaton Norris, near Manchester. The boiler was 20 feet long, 9 feet wide, and 10 feet deep, and weighed about 8 tons. On a Saturday night the water was blown out of it through the plug-hole at the bottom, by the pressure of the steam, the man-lid not being removed. On Sunday evening the fireman proceeded to take off the man-hole cover to clean the boiler; on entering it with a candle and lantern, a violent explosion occurred; and the man was projected to some distance and killed. On examining the boiler it was found quite dry, no fire being alight, no traces of water near it, and it was quite cold: it had been lifted from its seat up to the roof, which it destroyed, and the walls of the building were thrown down. There was no difficulty in accounting for the presence of a combustible gas, as hydrogen might be evolved from the decomposition of the steam (which would remain in the boiler after the expulsion of the water) by the heated sides and bed of the boiler, and the atmospheric air which entered through the plug-hole or through the man-hole, when the lid was removed, was sufficient to form an explosive mixture. The projection of the man was the simple effect of firing the gas; but to account for the entire boiler being carried from its seat, was more difficult. The figure of the boiler after explosion, exhibited two distinct actions; the ends and sides had evidently been bulged outwards by the force of the explosion within it, and the bottom had been crushed upwards by the force which raised it from its seat.

Mr. Parkes thought the circumstances admitted of a satisfactory explanation, but would not then enter upon it, as it involved the history and phenomena of projections of vessels from their beds with a vacuum within them, which he thought would be better understood after the reading of his paper on the "Percussive Force of Steam and other Aeriform Fluids," then in preparation for the Institution.

The foregoing case of the formation of hy-

drogen gas in a boiler, after all the water had been evacuated, was confirmed by one which took place in a similar manner at the sugar-house of Messrs. Rhodes and Son, in London, of which all the particulars had been furnished to him by Mr. Henrickson, the manager. A man entering the boiler with a candle and lantern to clean it, was projected to a great height. No rupture of the boiler took place, as the quantity of hydrogen seemed to be comparatively small, and to be confined to the upper portion of the boiler, but a series of detonations occurred, like successive discharges of cannon.

These two remarkable instances showed the importance of attending to minute circumstances in the management of boilers. The practice of completely blowing out boilers whilst the flues were intensely heated, was evidently dangerous, nor should it be done without removing the man-hole cover.

Mr. Parkes felt that these notices of explosions were very imperfect without drawings, and reference to documentary evidence, but, as the subject had been brought before the Institution by Dr. Schafhaeutl, he hoped that they would be received as contributions to the stock of knowledge, and as illustrative of the precautions to be observed by attendants on steam engines.

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Mr. Seaward was glad to find the idea of the explosions of boilers arising from the formation of hydrogen gas, so successfully combated by Dr. Schafhaeutl and Mr. Parkes. He perfectly agreed with the former in his opinion of the causes of the majority of explosions. In all that he had witnessed the effects of, the lower parts of the boiler appeared to have suffered most.

He was at the Polgooth Mine immediately after the explosion there, when 17 persons were killed. In that case, he was told that the boilers were moved a distance of seven or eight feet from their seats, before any detonation was heard.

At the Hurlam Mine (which Trevithick had undertaken to drain for a certain sum) an engine with a cylinder of 40 inches diameter was erected immediately over the shaft. Its power was not sufficient for the work required; the pressure of steam was therefore gradually increased as the depth became greater. At length the boiler, which was of an immense length, was observed to have a constant tremulous or sinuous motion at each stroke of the engine, and eventually it exploded.

It appeared that there were fewer explosions of boilers in London, in proportion to the number employed, than in any other district. One reason for this might be, that fuel being expensive, it was used economically, by maintaining a slow rate of combustion, and a regular supply of steam, avoiding the intense action of the fire, which, in the event of the engine standing still for a time, had a tendency to produce an explosion.

Mr. Parkes attributed the small number of explosions of boilers in the vessels on the Thames to the practice of allowing the steam to act upon the safety valve, instead of the engineer lifting it when the engine was stopped, as on board vessels in the north. The sudden closing of the valve had in many cases produced an explosion. While on this subject, he felt it necessary to comment upon what he considered fallacious reasoning of Tredgold on the formation of hydrogen gas in boilers.* The passage he alluded to was couched thus: — "Hydrogen gas may be, and frequently is, formed in steam boilers through the water being in contact with a part of the boiler which is red hot; and it seems to be regularly produced during the formation of steam at very high temperatures." Dr. Schafhaeutl had shown, that the effect of water coming suddenly in contact with a part of the boiler which was red hot, was only to disengage instantaneously a large volume of steam of very high elasticity. Mr. Parkes contended, that an instance of the sudden production of hydrogen gas in a boiler under such circumstances was unknown, and he much doubted the possibility of such an occurrence. Again, allowing such an event to be possible, an explosive mixture of gases must be formed before the boiler could be destroyed; and this could not take place so long as a sufficiency of water was present, from which any considerable quantity of steam could be generated.

Mr. Donkin did not entirely agree as to the non-formation of hydrogen in boilers under peculiar circumstances. He conceived the explosions which occurred in iron founderies, on the contact of the melted metal with wet sand, to be analogous. He believed, that when water was thrown suddenly upon red-hot plates, decomposition did occur.

He had once examined a wagon-shaped boiler which had exploded; the top was thrown to some distance, and the bottom was depressed throughout its entire length. He believed, that by intense firing the water had been nearly all evaporated; the bottom had then become red-hot, the pressure of the steam had forced the bottom downwards when weakened by the heat; the water on each side then suddenly flowed on to the heated part, and an explosion instantly occurred.

Mr. Seaward had known instances of the internal tube of a boiler being collapsed with-

* Tredgold on the Steam Engine, vol. i. p. 251. Edition by Woolhouse.

out any injury to the external part or body of the boiler. He had always ascribed such occurrences to a deficiency of water; but Dr. Schafhaeutl's explanation of the rapid transmission of force through the wave to the bottom would sufficiently account for the effects which had been observed.

Mr. Donkin believed, that in almost every case the unequal pressure upon the exterior of the tube, arising from its not being perfectly cylindrical, was the cause of its collapsing.

Mr. Field was inclined to attribute all the explosions which he had witnessed to simple pressure.

When steam, or a small quantity of water, was suddenly admitted into a dry heated vessel, hydrogen gas was readily formed. He had made several sets of apparatus for the purpose. A strong wrought-iron tube was heated, and, being filled loosely with fragments of iron-turnings, steam was introduced, and the gas was rapidly evolved.

He agreed with Mr. Parkes in condemning, generally, the fallacy of the opinion of Tredgold, previously mentioned, as to the formation of hydrogen gas. Still, in a large boiler, almost dry, and of which a portion was red-hot, he conceived, that on the admission of a small quantity of water, hydrogen gas might be evolved.

The President was unwilling that this conversation should terminate without endeavouring to explain the cause of the elevation of the boilers from their seats. In his opinion, this might be satisfactorily accounted for by the action of atmospheric pressure.

When an explosion took place in a boiler, a considerable body of highly elastic fluid was disengaged; a partial vacuum was thus created above the boiler, whilst the full pressure of the atmosphere was exerted beneath it. This would cause the boiler to rise from its seat, provided the atmospheric air did not at the same instant rush into it, in which case the bottom would be pressed downwards, and the upper part being torn asunder, as had been described, would then rise into the air with the elastic fluid.

When it was considered that the superficial area of these boilers was about 60 square feet; that the pressure of the atmosphere was nearly 1 ton per square foot, and that the weight of the boilers was only 8 or 10 tons, it would be apparent that the cause was quite adequate to the effect, with a very partial vacuum or inequality of atmospheric pressure. The case was analogous to those in which light bodies were raised into the air by whirlwinds.

He referred also to two cases of an equally uncommon nature, which had lately come under his notice professionally, and which he considered to arise chiefly from inequality of atmospheric pressure.

The first occurred at the Plymouth Breakwater, during the great storm in the month of February, 1838, when several of the largest granite blocks, weighing from three to eight tons each, composing the surface or pavement of the breakwater, which, although squared and dove-tailed into the structure, and embedded in excellent cement to the extent of their whole depth, and thus forming a solid mass, were torn from their positions, and projected over the breakwater into the Sound. He attributed this to the hydrostatic pressure exerted beneath the stones, at the moment when the atmospheric pressure above had been disturbed by the masses of water suddenly and rapidly thrown upon the surface of the breakwater. Blocks of stone were thus often carried to a great distance, not so much by the waves lifting them, as by the vacuum created above them by the motion of the water, which exerted at the same time its full pressure from below.

The other case occurred during a storm in the year 1840, when the sea door of the Eddystone Lighthouse was forced outwards, and its strong iron bolts and hinges broken by the atmospheric pressure from within. In this instance he conceived that the sweep of the vast body of water in motion round the lighthouse had created a partial and momentary, though effectual vacuum, and thus enabled the atmospheric pressure within the building to act upon the only yielding part of the structure.

### ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

*** *Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for the purpose.*

NATHAN WADDINGTON, OF HULME, LANCASHIRE, ENGINEER, *for certain improvements in the construction of steam boilers, and furnaces for heating the same.* Enrolment Office, July 26, 1841.

The boiler for stationary engines, for about half its length from the front, is formed of portions of two large circles connected by a smaller one, supported by stay plates attached to the larger portions on each side of the smaller one, spaces being left between the stay plates for the passage of water and steam. At the end of this half of the boiler the smaller portion of a circle and the stay plates terminate, and the two larger portions of circles assume the form of two cylinders,

and gradually descending a little, then proceed horizontally a short distance. These cylinders are enclosed within a flue which causes the heated air from the furnace to impinge upon, pass round and between them.

The water is admitted by a feed-pipe to the lowest part of the cylinders, so that the boiler is filled with water at its lower extremities, whilst the upper part is occupied by steam and water in nearly equal proportions. The furnace is placed under the front end of the boiler, and on each side of the fire-grate are dead plates, on which the coals are received from feeding-mouths above, which are closed by the coals when the furnace is in operation, but at other times by doors. The fire is raked, or the fire lighted, through a door sliding vertically in front of the furnace; the fire-bars descend towards the middle of the furnace to facilitate the raking of the coals from the dead-plates to the centre of the fire. The coals lying on these plates become coked and their gases liberated, which passing over the intensely-ignited fuel, are effectually consumed.

The marine boiler, is formed of a number of portions of circles, divided in the interior by a series of plates by which the water is prevented from rushing to one side or end of the boiler, when the vessel rolls or pitches. To the bottom of the hinder part of the boiler several small cylinders are attached, their lower ends, which are in the flue, being closed, and their upper ends opening into the boiler; they are placed obliquely, and intersect each other so as to abstract as much heat from the flue as possible. The furnace is smilar to that described above, and rests upon a casing filled with water to guard against accidents from fire.

The claim is 1, To the construction of steam-boilers, when formed throughout their entire length of a combination of circular parts and staying-plates, or when only a portion of their length consists of the combination of circular parts, and the remainder of cylinders, in either case accessible in all their parts by one man-hole. Also the cylinders which intersect each other in the flue, when they are used in combination, and form parts of the steam-boilers used for marine or inland navigation.

2. As regards the furnaces for heating the boilers, to the combination and arrangement of those parts on which the fuel is supported and submitted to the coking or roasting action of the furnace.

3. To the arrangement of the furnace doors and the grate-bars, when they are combined with the coking and roasting parts, but not otherwise.

Peter Fairbairn of Leeds, Engineer, and William Suttill, of Newcastle-upon-Tyne, Flax-spinner, *for certain improvements in drawing flax, hemp, wool, silk, and other fibrous substances.*—Petty Bag Office, July 26, 1841.

At each end of the machine two barrels, or wheels with double flanges on horizontal shafts revolve in suitable bearings on the standard frame, and carry two endless leather bands furnished with longitudinal rows of pins, similar to heckle points. Between these endless bands, a series of transverse heckle-bars work on the principle of the screw-gill, travelling a certain distance along the machine. A strick of flax, &c., to be operated upon, is placed transversely across the hinder end of the machine, the portion near its ends being inserted between the pins upon the endless bands, and are pressed down upon the endless bands by narrow rollers fixed upon a shaft, which turns loosely in forks standing up from the side frames, which keeps the fibres tightly distended. The fibres in the middle of the strick are then taken forward by two conductors to two feeding-rollers, which lead them to the heckle-points of the screw-gill, these points draw out the fibres from the pins of the endless band, leaving the tow between them, and carrying the clean fibres forward to the drawing rollers. The relative speeds of the endless bands, the heckle-bars and feeding-rollers, and the drawing-rollers, are as 1, 10, and 20. On passing the drawing-rollers the fibres assume the state of sliver, and are conducted through a trumpet, and between the delivering-rollers into a can, in which they are carried to other machinery for the processes of drawing and refining.

The claim is to the arrangement of such known agents as will afford the means by which the fibres of flax, hemp, wool, silk, or other fibrous materials placed transversely in the machine, may be drawn from the middle of the strick, instead of end-ways, as heretofore, for the purpose of breaking the long fibres to nearly an equality of length with the short fibres, and thereby drawing them into a sliver of nearly uniform staple. Also the adaptation of lateral heckle-points, by which the ends of the stricks may be held, and the tow, floss-silk, nolls of wool, or other loose and short fibres, drawn out of the ends of the stricks, by the traction speed of the feeding-rollers, and travelling gill-heckles.

William Currie Harrison, of Newland-street, Pimlico, Engineer, *for an improved turning-table for railway purposes.* Enrolment Office, July 28, 1841.

A strong upright post is formed at top into a pivot, which carries a cap in the centre of the revolving plate or platform of the table; a number of suspending rods pass up through this cap, and are secured by screw-

nuts, while their lower ends pass through a friction roller-case near the bottom of the post, where they are secured by nuts, serving also for the axes of the rollers, which traverse round the post when the table is turned. The post is securely held by strong braces, (which, as well as the bottom of the post, are set in concrete stone or brick-work,) and are brought up in an inclined direction to the outer ring, within which the upper platform of the table turns.

The claim is to the improved turning-table, as described.

EZRA JENKS COATES, OF BREAD-STREET, CHEAPSIDE, MERCHANT, *for improvements in the forging of bolts, spikes, and nails.* (A communication.) Enrolment Office, July 30, 1841.

The metal in sheets is fed into a hopper, whence they descend to two splitting rollers, which divide them into rods which rest with their lower ends in the bottom of a narrow trough, where a rammer presses them against the back of a tube down which they are successively forced in order to convey them to the dies.

On passing through the tube the rod is held by two side-holding steel dies, and a back die lying in a kind of vertical trough, its front side pressing against the periphery of a circular steel die, or disc, which is capable of turning, but acts principally as a fixed surface. When the back and side dies descend, they press the rod against the edge of the stationary disc, by which means the rod is drawn into a point—the back die being suitably formed for pressing it into a point on the side opposite to the disc. By the descent of the dies, the point of the nail is drawn below the disc, and the front side of the nail left unsupported, a front holding-die is therefore brought forward to support that side, and the further descent of the dies forces the lower end of the nail on to a heading die, and forms the head.

After each point is formed, the disc, which is kept well oiled, is turned partly round to present a fresh part of its edge to the next nail.

WILLIAM WILKINSON TAYLOR, OF BARROW-FIELD-HOUSE, WESTHAM, ESSEX, GENTLEMAN, *for improvements in buffing apparatus for railway purposes.* Enrolment Office, August 1, 1841.

These improvements consist simply in sowing or carding several thicknesses of felt to the ordinary buffer-heads, covering the whole with leather, or other water-proof material. The patentee prefers, however, a buffing apparatus formed by several thicknesses of felt attached to a board equal in length to the width of the carriage, and affixed to it by two projecting bars passing through sockets attached to the side framings of the carriage and secured by keys. In this form it is adapted for locomotive engines, but when applied to railway carriages, a hole is cut through the board and felt for the coupling irons to pass through.

The claim is to the mode of constructing buffing apparatus for railway purposes, by applying felt in a series of layers as described.

CHARLES HOOD, OF EARL-STREET, BLACKFRIARS, *for improvements in signals.* —Enrolment Office, August 1, 1841.

A suitable receiver is filled with air condensed to about 45 lbs. per square inch, by means of a condensing syringe; this receiver is provided with a tube to which a whistle is attached, similar to the steam-whistle of locomotive engines, but rather smaller. A stop-cock is placed upon the tube between the whistle and the receiver, on turning of which, the condensed air passes through, and sounds the whistle. This contrivance enables the guard of a railway train to give a signal to the engine-driver, in case of accident of any kind. It is also applicable to steam-boats, or to railway-stations, for giving signals at night, or in foggy weather.

A second signal apparatus consists of four wedge-shaped leaves or panels, which are centred at their pointed ends, describing an arc of 45°, and spreading out like a fan. These leaves are attached to each other in such a manner that on pulling a cord, the lowest leaf is drawn up behind the second, the second leaf behind the third, and all three behind the fourth; lastly, the four are drawn up into a case, by which they are concealed. Each leaf is painted a different colour, indicating some arbitrary sign. The raising or lowering of these fan-like leaves may be done by hand, or by means of machinery. For night-signals, each leaf has a pane of glass let into it, on which figures, &c., may be painted, to indicate fixed intervals of time, when worked by clock machinery. On an engine-driver approaching one of these signal stations, the colour or number of the leaf that is visible will convey the intelligence desired, to stop—to proceed cautiously, or any other signal. If no leaf is visible, no signal is to be communicated, and he will fearlessly continue his progress.

The claim is, 1. To the mode of giving signals by applying condensed air in apparatus, in combination with whistles. 2. To the mode of giving telegraphic signals on railways, by means of moveable leaves or panels, worked either by hand, or by machinery, or by both means conjointly, and combining therewith clock movements, or other similar machinery, for producing a gradual and ascertained velocity of motion in the

leaves or panels of the telegraph, and for the continuous sounding of an alarm bell, as described.

WILLIAM WARD ANDREWS, OF WOLVERHAMPTON, IRONMONGER, *for certain improved methods of raising or lowering windows and window-blinds, and opening and shutting doors, which are also applicable to the raising and lowering of maps, curtains, and other articles*; altered by disclaimer, July 30th, to *certain improved methods of raising and lowering window-blinds, and opening and shutting doors.* Enrolment Office, August 2, 1841.

The blind roller is fitted with brass caps, that at one end carry a pin, at the other an axis with a small pinion, both of which are supported in metal cheeks placed on each side of the window; the pinion gears into a toothed wheel placed below it, furnished with a drum or barrel, round which the tassel cord is wound by pulling down the blind. In order to raise the blind, the tassel cord is pulled, which turns the toothed wheel, and drives the pinion rapidly in the opposite direction, thereby winding up and raising the blind.

To prevent the blind being drawn down by its own weight, a collapsing spring ring is put round the axis of the pinion, a boss on which comes in contact with a click affixed to the side of the box when the blind is descending, but passes it freely when the blind is wound up; by which means the blind is kept at any required height.

For shutting doors, an upright shaft or pintle is passed through a square hole in a metal plate, a few inches up, into the cross-stile of the door; the lower end of this pintle works in a conical socket formed in the bottom of an oil-tight box, which is let into the floor. At the lower end of the pintle there is a pinion working into a cogged eccentric, which turns on a centre, and is furnished with two anti-friction rollers, which work against a cross-plate abutting against two strong spiral springs. On opening the door, the pintle and pinion will turn with it, moving the eccentric in the opposite direction, and thus causing one of the anti-friction rollers to push forward the cross-plate and compress one of the spiral springs, the reaction of which closes the door when left to itself. At the upper end of the door a plate of metal with a conical socket is inserted, and a similar plate is screwed to the lintel over the door, furnished with a screw plug, the conical end of which fits into the socket. In order to hang the door, the plug is screwed round, quite up into the lintel, by means of a collar pierced round with holes for the insertion of a lever. The top of the door is then brought under it, (the bottom being placed on the pintle below,) and the plug screwed round till its conical end fits into the conical socket, when the door is perfectly hung. A modification of this mechanism is also shown.

WILLIAM ORME, OF STOURBRIDGE, WORCESTERSHIRE, IRON-MASTER, *for improvements in the manufacture of cofered spades, and other cofered tools.*—Enrolment Office, August 3, 1841.

Instead of making the spade, or other tool, by welding two "half moulds" together, the mould is formed of a single piece of iron of the same shape as if made of two "half moulds." This mould being made red-hot the part that is to form the straps of the spade is divided by a circular saw, and a wedge-shaped tool driven in to form the cofer; it is then steeled on the cutting edges, and finished in the usual manner.

The claim is to the mode of making cofered spades, and other cofered tools, by dispensing with the use of the two "half-moulds" heretofore employed in making such spades or tools, and in forming the straps and cofers of spades, and other tools.

WILLIAM HANCOCK, JUNIOR, OF KING-SQUARE, MIDDLESEX, *for an improved description of fabric suitable for making friction gloves, horse-brushes, and any other articles requiring rough surfaces.* Enrolment Office, August 3, 1841.

These improvements consist in causing the ends of horse-hair, or other suitable materials, to stand perpendicularly to the plane of the surface, whereby a fabric is produced peculiarly adapted for the purposes enumerated. This fabric is produced by weaving; the loom used being similar to the velvet loom, but differing from it by having the ground-bar, and ground or chain roller of the ordinary mat-loom, instead of the ground-bar of the velvet loom only; and also in having the breast-bar and knee-roller of the mat loom, in lieu of the breast-roller of the velvet loom.

Fine hempen or cotton yarn, or other suitable materials, may be used for the warp or ground, while the pile may be of spun or unspun horse-hair, either alone or in combination with spun wool or cotton, Manilla fibre, cocoa-nut fibre, fine split cane, or whalebone. A shoot of fine spun hemp is used, being wound on box-wood pipes, and fastened in the shuttle.

The weaving is like ordinary velvet weaving, and the pile cut to form the rough surface in the usual way. If properly done, the horse-hair will be fixed sufficiently firm for all ordinary purposes; but, in order to fix it with additional firmness, a weak solution of gum tragacanth, or a solution of caoutchouc, may be used. The fabric thus produced may be made into flesh-gloves, horse-brushes, &c., or may be used for covering seats of chairs, for mats, rugs, &c. &c.

The claim is to the application of horse-hair, and of horse-hair in combination with

other substances, for the production of the improved description of fabric, suitable for the various purposes mentioned. Also the alterations in the ordinary velvet looms, when they are made and used combined, or in combination with the manufacture of the improved description of fabric.

JOSEPH SCOTT, OF GREAT BOWDEN, NEAR MARKET HARBOROUGH, LEICESTERSHIRE, TIMBER-MERCHANT, *for improvements in constructing railways, and in propelling carriages thereon, which improvements are applicable to lowering or raising weights.*—Enrolment Office, August 8, 1841.

At short intervals along the centre of the railway, a number of cog-wheels are supported on axles in suitable bearings, and driven by stationary steam-engines, placed a mile asunder. Each engine gives motion to a large cog-wheel, which drives one of the cog-wheels before mentioned, from which motion is communicated by means of endless chains passing round drums on the axle of each of the wheels, to all the cog-wheels, for half-a-mile on each side of it. To the under side of the carriages a rack is affixed, and kept in contact with the cog-wheels by springs, but capable of being raised when necessary. The rotation of the cog-wheels impels the carriages, which are kept in the right tracks by guiding-planks, which bear against anti-friction rollers, carried by the standards that support the axles of the cog-wheels. In order to stop the carriage, the rack is lifted up from the cog-wheels, and the guiding-planks pressed forcibly against the anti-friction rollers.

The claim is to the mode of applying cog-wheels, and requisite gearing to railways, such cog-wheels taking into toothed racks, applied to railway-carriages; also, the application of such means to the raising of weights up inclined surfaces.

JAMES JOHNSTON, ESQ., OF WILLOW PARK, RENFREWSHIRE, *for improvements in obtaining motive power.*—Enrolment Office, August 8, 1841.

The patentee does not confine himself to any particular form of engine, but to the working of it as follows:—A quantity of the mixed gases (one part oxygen to two parts of hydrogen) is admitted into the cylinder below the piston and exploded, which drives up the piston to the top of the cylinder; as soon as the expansion of the gases has ceased, a small quantity of water only remains, and a vacuum is produced beneath the piston, while the mixed gases are admitted into the space above, and similarly exploded. Each explosion thus forces the piston into the vacuum formed on the opposite side of the piston by the previous explosion, and the working of the engine in this way maintained.

The claim is to the working of an engine by the joint action of the explosive and condensive properties which certain proportions of oxygen and hydrogen gases possess when exploded together.

ELISHA OLDHAM, OF CRICKLADE, WILTS, RAILROAD CONTRACTOR, *for certain improvements in the construction of turning-tables to be used on railways.*—Petty Bag Office, August 8, 1841.

The upper platform of the table is composed of a strong iron framing, filled in with wood, and supported at its centre upon an upright pin or pivot, lubricated by means of an oil-chamber immediately over it. At the extreme edge, or at a point nearer to the centre, the platform is supported upon eight iron anti-friction rollers, mounted in bearings upon a stationary cast-iron framing.

The whole weight of the carriage, &c., rests entirely upon the centre pin, when the platform is properly balanced; but if the weight is unequally placed, one side of the platform will be sustained by the anti-friction rollers.

The claim is to the arrangement of parts herein described, as applied to the construction of turn-tables; or any other arrangement in which the moveable platform is supported on a pin or pivot at its centre, and assisted by stationary anti-friction rollers at its sides, in the manner described.



## NOTES AND NOTICES.

*Superb Fire Engine.*—The American fire-engines are celebrated for the gorgeous character of their decorations: in several instances, however, they have been fully equalled, if not surpassed by the exercise of British taste, among others by some that have been built for the West of England Insurance Company. One of these built about six years since, and at the time noticed in our pages, was named "Victoria," in honour of the Princess. Mr. Merryweather, of Long Acre, has recently completed another engine of a still superior character, both as to the extent of its powers and the beauty of its decoration, for the principal office of this spirited company at Exeter. This engine, which has been named "Prince Albert," was tried at Exeter a few days since, when the elegance of its appearance and the excellence of its performances, gave great and universal satisfaction. G. W. Cummins, Esq., Civil Engineer, and Superintendant of the West of England Fire Brigade, in a letter just received, pronounces it to be "the best engine and workmanship he has ever seen."

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# Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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## SMITH'S IMPROVED PLOUGHS

Fig. 1.

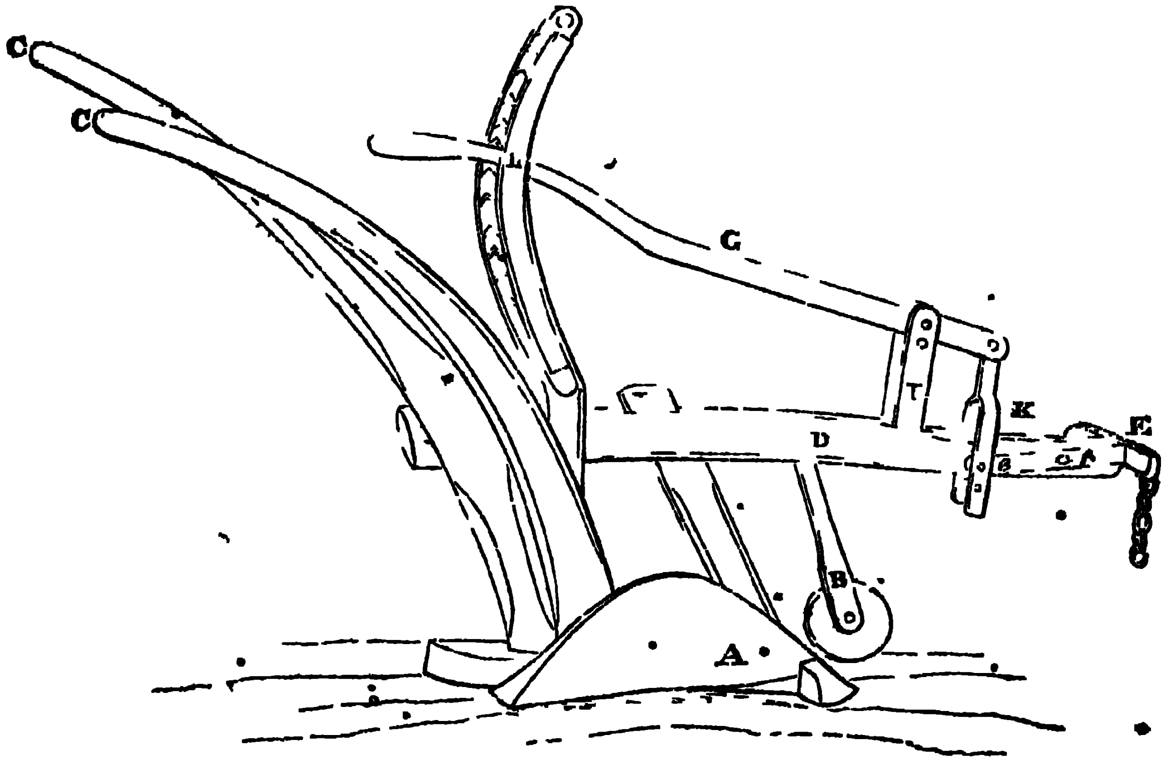
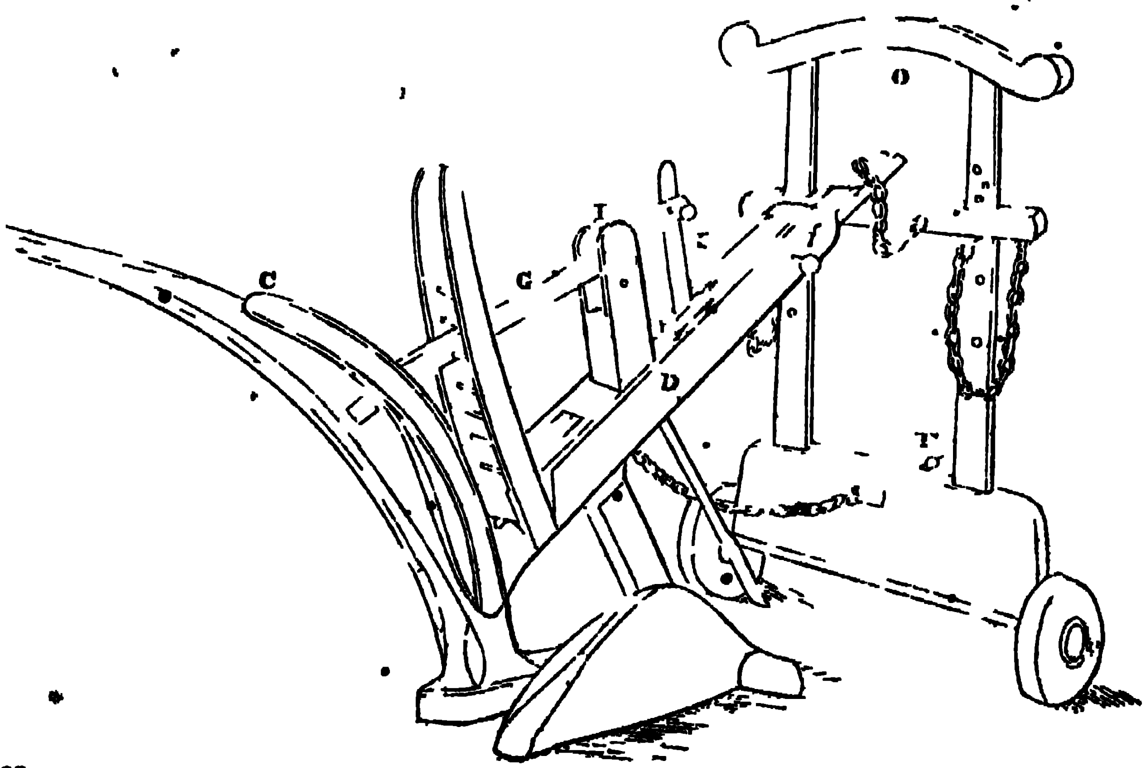



Fig 2.



It is with much pleasure we witness the improvements which the rapid progress of mechanical and chemical knowledge is daily contributing to the science of agriculture.

The plough, that staple instrument of field husbandry, has long exercised the mechanical talent of agriculturists, and has grown up from its first rude and simple form, into a machine replete with artistical skill.

The improvement of this essential instrument, although carried to a great length, will doubtless still furnish an unexhausted subject for the exercise of mechanical ingenuity.

Upon the present occasion we have to submit to the notice of our readers, several contrivances well calculated to extend the usefulness of the plough, which form the subject of a patent recently granted to Mr. Theophilus Smith, of Attleborough, Norfolk.*

These improvements in ploughs consist in the addition thereto of certain contrivances, by means of which, both the breadth and depth of the furrows can be regulated and varied at will by the person using the plough, without stopping it for that purpose.

Two of the provisions for increasing or diminishing the depth of the furrows, are shown by the engravings on our front page; Fig. 1, showing the requisite modification of what is commonly called a Fen Plough, and fig. 2, a mode of effecting the same object in wheel ploughs.

In fig. 1, A is the breast and share; B, the coulter; C C, the handles; D, the beam; E is the hake to which the drag-chain is attached, moving vertically upon a centre-pin at *f*, which passes through the two side irons of the hake, and through the beam. G is a lever working through a guide-frame H, and centred on a fulcrum-pin in an upright I. A forked connecting piece K, connects the lever G with the inner extremities of the hake irons *e*. Several holes are provided for the insertion of the pins, both in the connecting piece K, and in the upright I, in order to increase the range of the adjustment at pleasure. Within the guide-frame H, on the left side, there are a number of projecting pins or studs for the purpose of holding the lever G in any position in which it may be placed. A spring on the side of the lever presses against the opposite side of the guide-frame and keeps the lever constantly between the pins.

On raising the handle of the lever G, its other end with the connecting piece K, and the inner ends of the hake irons *e*, are depressed, which raises the drag-chain and causes the point of the share to cut deeper into the earth.

On the other hand, if the handle of the lever G is depressed, the drag-chain is lowered, and the depth of the furrow proportionally diminished. The apparatus just described is equally adapted for raising or lowering the hake of all kinds of swing ploughs.

Fig. 2, shows an arrangement of mechanism for varying the depth of the furrow as applied to wheel ploughs. A, as before, is the breast and share; B, the coulter; C C, the handles; D, the beam, the end of which is jointed, turning upon a centre-pin at *f*, and its extreme end resting upon the cross-rail of the frame, or gallows O, to which it is fastened by a pin. This cross-rail can be set at any required height, by shifting the pins in the two upright sides, upon which it is supported. The frame O is mounted on a pair of small wheels, and is drawn by the drag-chain E; it is attached to the plough-beam by the chain P. G is a lever working in the guide-frame H, and centred on a fulcrum pin in the upright I. One end of the lever G is attached by a connecting piece K, to the inner end of the jointed portion of the beam. Steadying pins are placed within the guide-frame as before described. By moving the lever G up or down, the position of the beam is altered, and the plough-share raised or depressed, and the depth of the furrow increased or diminished as before described.

Mr. Smith has shown several modifications of these plans; in some cases the object being effected by simple levers, in others by bell-crank levers, worked either by levers or by screws.

For the purpose of keeping the

* Specification lodged at the Enrolment Office, August 15, 1841.

plough coincident with the line of draught; or for setting it at any required angle to the same, the patentee describes several simple, but ingenious arrangements.

In swing ploughs this is effected by the use of a toothed segment turning on a centre, in front of which the hake iron is placed; this segment is moved to the right or to the left by a trundle, acting in combination with any of the arrangements before described.

In wheel ploughs, the cross-rail that carries the end of the plough-beam is placed between two uprights which pass up through the top rail of the frame, and carry a horizontal toothed rack; a pinion takes into this rack, the axis of which is prolonged to the plough-handles, and, being turned, causes the beam of the plough to traverse to the right or the left, as may be required. If preferred, a pulley and chains may be employed for traversing the uprights, in lieu of the rack and pinion.

These improvements appear to us to be of great practical value, and they have been spoken of, by some of the most experienced judges in these matters, in terms of the highest commendation.

## REMARKS ON PILBROW'S CONDENSING CYLINDER STEAM-ENGINE.

Sir,—If a stranger intruding on your notice may hope to receive a share of the attention due to the able and well-recognised correspondent, I would show, conscious of the risk of the attempt, that "Pilbrow's Patent Condensing Cylinder Steam Engine," instead of realising more power than the present condensing engine, will be attended with much loss of power in the comparison. The following reasons are those on which I found such a conclusion.

On the steam leaving the one cylinder to be condensed in the other, it will oppose the progress of the steam piston with far more effect than it now does, because the space it has to enter, as shown by the "drawing A" in No. 30 of your valuable Magazine, is, in fact, nothing; whereas, in the common engine, the steam has the spacious void before it, of both air pump and condenser.

But it is absolutely necessary to beget the full maximum effect of the steam-engine, that the passage between the cylinder and condenser be open before the termination of each up and down stroke of the engine; because the steam takes more power from the engine by back resistance on the piston when only beginning to leave the cylinder as the stroke has terminated, than is really gained by the steam during the last fifth of the stroke. *Query.* Will Pilbrow's engine allow the steam to precede the motion of the piston in this manner? By condensing the steam of one engine in the condensing cylinder of the other, when two engines are working together, with cranks at right angles, this object may be gained; but where would exist the shadow of a chance to obtain the gain looked for, through the difference of vacuums on either side the piston of the condensing cylinder?

We are not informed through the Magazine, that an arrangement like the above is contemplated by the patentee, though something very like it is mentioned in the extract; but be there two engines or one only, having steam going in for condensation, as premised, it will be found the most effective way to beget the maximum effect of the engine, though the hope that extra power will this way be obtained can never be realised.

The gain which is to be had from the denser medium of the condensing steam on the one side of the piston of the condensing cylinder, from there being on the other side of the same piston a better vacuum, is altogether a mental hallucination, as the following will show.

First of all, it is evident that the steam has no place to enter, according to the "drawing A" already referred to. Condensation, of course, there can be none; nor till the piston of the condenser has given room for the entrance of the steam, and play of injection-water, can there be any expected. This, together with the time allowed the discharge valve, at the top and bottom of the condensing cylinder to close, must pall the whole energy of the engine. The

steam, by the time condensation would here commence, would be entirely out of the cylinder of the common engine. The moment—the vital moment—to obtain the maximum delivery of steam power throughout the stroke is here entirely lost.

If, therefore, the engine begins each up and down stroke with the worst vacuum possible, and in the worst way possible in respect to lead, the vacuum at the termination of every such stroke of the condensing cylinder piston must be of the very worst class, instead of, as we are told, being one of the purest that can be had in a condenser.

Granting, however, that a purer vacuum will be found on the opposite side of the condenser piston at the termination of each alternating stroke of the engine, the amount of it generated by condensation, is the only true and efficient vacuum; not that over and above the vacuum so begot—not that which the steam-engine generates against itself, by dragging the condenser piston along the cylinder against the medium, which though now it is considered the weakest medium, was but this instant reckoned the source of gain, being the denser medium of the two on either side the piston. Action and reaction so palpably transformed to the generating of the smallest virtual purity of vacuum, is too gross to escape instant detection.

To round and complete the argument, I am aware that the mean exhaustion of cylinders is less by 3lbs. per inch than the mean vacuum of condensers. But though there existed twice this desideratum in the present steam engine, Pilbrow's could not reclaim an ounce of it; for if the present engines, with steam entering the least possible resisting medium that is had by injection, or into the vacuum of 12 at the beginning of each alternating stroke of the piston, gives throughout a mean exhaustion of 7 to the cylinder—is it not evident, that with Pilbrow's engine, the steam having, in leaving the piston no vacuum of 12 to enter, nor even any space at all to receive it, at the commencement of every up and down stroke, but only as the space opening by the motion of the piston from the end of the condenser admits it,—is it not evident, I say, that in consequence of the vacuum between the end of the condenser and its piston, as it begins to be (granting it even begins effectually, being of the very lowest class, say 8½ as the lowest condenser vacuum,) the mean exhaustion of the steam cylinder will likewise be less, and that, instead of its being at the value of 7 in the cylinder by the steam entering a condenser of 12, it will be as much below 7 as 8½ is less than 12, or at the rate of 4½. For it is as much an impossibility, with this plan of condensing air pump, as it is with the present plain air pump and condenser, to exhaust the steam cylinder more or less, than as its exhausting power is stronger or weaker; and therefore, what is granted to be gained on the one hand, is to a demonstration lost on the other.

Sir, may I be allowed here to inform your numerous readers, that one real improvement can actually be wrought in this admirable work of human invention—that which has ever been, and is desired, namely, the employment of any quantity of injection-water, without diminishing the maximum effect of the engine arising from the superior vacuum obtained; as by requiring a greater, an equal, or any power whatever to draw the water again from the condenser, the power that would at present be required being saved by a most simple affair, that requires hardly a bolt of the engine to be disturbed to make it work with the improvement in any shape or build of engine whatever.

I am, Sir, most truly and respectfully yours,

LOWEMNAPHRETTS.

Limehouse, July 14, 1841.

### THE SYMINGTON TESTIMONIAL.

Sir,—I have read with great delight your triumphant vindication of the exclusive right of William Symington to the invention of steam navigation, and your stirring appeal to the gratitude of the nation in behalf of his family.

Stupendous are the energies of truth, and ever to be venerated that Power, which, in its own proper and allotted season, calls upon some individual to rise up and make full reparation to the injured or traduced. Time is the sword of justice, and sooner or later descends

with terrible severity on behalf of all who need its aid. At length the world knows, beyond question, the individual to whom it owes so much. Justice has at last been done; and the sympathy you have expressed for the misfortunes of Symington will, it is hoped, wake the slumbering echoes in the hearts of the public, not to cease until they have answered adequately to the appeal. The subtle distinction which you have drawn between the perseverance arising from the conviction of experience, in the case of Fulton, and that arising from the true instinct of genius, in the case of Symington, has furnished new materials for future comparison, and an enlarged fund from which to award a greater degree of praise to the highest quality of the human mind. But it is not my province to criticise the beauties or defects of a paper that has so well fulfilled its object; which, enlarging its rays to a wide-spreading circle, has embraced so great a variety of matter connected with the subject, concentrated the whole to one focus, and brought it to bear with irresistible power in the discovery and support of the genius and claims of the true inventor of steam navigation. A proof of title so complete, and a discrimination so just, of the several pretensions of Miller, Taylor, and Fulton, with the fair praise awarded to each, must, I think, set the question for ever at rest. As to Taylor's claims, we can only feel pity for those who have been entrapped into their support. The voice of the public now calls upon the Messrs. Chambers, in a tone that they must hear, to which, for their own honour, they can no longer be deaf, either to prove the cause they have voluntarily brought before their numerous readers, or to admit, as extensively as they have given circulation to Taylor's claims, that they have been deceived. At the dinner lately given to them at Peebles, they professed ever "to keep aloof from prejudices and prepossessions, and in an especial manner to write in the cause of the poor and helpless." Let them now act up to this assurance, in further investigating Taylor and Symington's claims.

As regards Mr. Russell's work, I cannot help saying a word or two here. I was surprised to see so much incapacity of judgment joined to so much fidelity of narration; so much erroneous deduction, from correct premises. I have gone through the book, and cannot but praise your merciful consideration of it; though it is evident your own conviction of his numerous errors has been gradually contending against your desire to use him tenderly. You have fairly argued yourself out of your first favourable impressions. Be assured, Mr. Editor, that the sin of criticism of the present day is not severity —it is a fond and unwise leniency. Any thing is pitchforked now to the gaping multitude of readers. Skin a few authors who deserve it; cut off the long strings of titles they affix to their names, as tails to kites, to keep them steady, and see how they would tumble down. Scrape their bones a bit, and we should not have such shoals of rubbish, or incomplete works, borne down on the floods of imbecility. I might say much of the errors in scientific principle, which so frequently disfigure Mr. Russell's lucubrations—much of his illogical reasonings and unsound practical views; but I shall content myself with pointing out more especially to animadversion various omissions of extreme moment to his subject, of which he has been guilty; his marked partiality to the Clyde engineers; the injustice he has done to our London and other marine engine-makers, (who are at least equal, I think superior, to any in Scotland,) by omitting *proper* notice of the productions of the Maudslays, the Seawards, the Millers, the Fields, the Penns, and other metropolitan engineers — by his too slight allusion to their exquisite engines, surpassed by none, if equalled by any, turned out in Scotland—by his passing over how much has been done by them for the improvement and extension of steam navigation, (as much by any one house, as by all the Clyde engineers together); and by his omission of all notice of our fleets of steamers supplied by London makers, that scud like clouds over the universe, with a speed unsurpassed. Reflecting on all these defects, and how doubly censurable they are in a work of the authoritative and permanent character of an Encyclopædia, I must confess to having thrown down the book with a degree of

regret amounting very nearly to disgust. The proprietors of such a work as the *Encyclopædia Britannica*, designed as it is for posterity, ought to know that they should employ none to write for it but men, not merely of original talent, cultivated by severe study to first-rate eminence in each department, but who have also ample time to make each contribution perfect; whose minds are void of prepossessions or preferences; who are unconnected, as patentees or otherwise, with any part of the subject treated of; philosophers, original thinkers, independent inquirers. The public will accept no apologetical prefaces of pressing avocations, or excuses of that sort. A writer enters into a compact with the public, when he writes for a work having the future in its vista, as well as with his employer when he takes his money; he has a duty to perform of a very onerous nature, and if he chooses voluntarily to undertake it, he is bound to sacrifice every other occupation for its best accomplishment, or the public, which the writer professes to instruct, is grossly deceived. Mr. Russell should have written to all the London marine makers for information, and explained his occupation. It is clear, by the able manner in which a portion of the work is treated, that there is no lack of talent in the author; but, looking at his manifold errors and omissions, at the important nature of the whole work, of which this treatise forms a part—that it is a reservoir of the intelligence of mankind, the representative, in particular, of the existing talent of Great Britain, and should be the most accurate history of her genius, and the past and present state of her arts and resources—the proprietors should be called upon by the purchasers of the seventh edition of the *Encyclopædia Britannica* to cancel one-half of the article, and beg Mr. Russell to re-write that half entirely.*

To return, however, to the more immediate object of this letter—your appeal on behalf of Symington, as a man of genius and benefactor of his country and of mankind—permit me to say, that I have ever felt a deep sympathy with genius. It is a great mystery, the undoubted communing of the Creator with man, a knowledge derived from no instruction, independent of all experience, which cometh and goeth, like the wind, where it listeth. I have stood in the Campanile, at Venice, where the ill-fated Galileo breathed out his woes to his solitary companions, the starred and solemn heavens, confined a prisoner by a bigoted priesthood, for discoveries the age was not prepared to receive. I have heard the lament of Tasso, in his narrow cell at Ferrara, and seen the tomb at Ravenna where Dante sleeps, far from his ungrateful Florence, an exile from his place of birth. I have trod the memorable spots where repose the bones of many other men of genius, and found in different countries a confirmation, that the misfortunes and miseries of the race are not confined to any particular soil. It is the lot of the greater number, and melancholy is the experience that has established it a truth. And yet, how little are they understood or appreciated whilst they live!

The fine expression of Milton,

"The debt immense of endless gratitude,"

is seldom, indeed, paid in life, and too frequently when there is opportunity for showing something more substantial to the descendants of an unfortunate son of genius "who scorned delight, and lived laborious days," to become "the servant of posterity;" posterity is content with mouthing its gratitude, *and nothing more*. Let us hope that mankind are becoming wiser in their generation, and wiser in their appreciation. We trust that the great spirit of civilization which Steam Navigation is spreading with undying energies, over the length and breadth of the universe, joined to the unexampled diffusion of a wiser knowledge, will sow broadcast the seeds of mighty impulses of benevolence, and teach the human race in future to pay as prompt reverence to the authors of useful arts (at least) as to the conquerors of nations. Already there have been erected more statues to Watt than to Wellington, or any military or naval hero on record; yet in life, Watt was allowed to struggle

* If our esteemed correspondent had waited for the appearance of our fourth and concluding notice of Mr. Russell's book, he would have found that we had not passed unobserved the defects of which he complains. He has very literally taken some of our own words out of our mouth.—Ed. M. M.

through the best period of existence, every year on the verge of bankruptcy, and a broken heart. Few know, indeed, how *very close* he verged on both. On Wellington, on the other hand, were showered in costly profusion, the wealth and honours of the nation. True it is, that few have ever lived who deserved his honours more. Invested with sovereign power, and directing the destinies of empires, he relinquished boundless sway to serve his country, and accustomed to the moral grandeur of commanding vast masses of men, gave up all for the retirement, and passionless existence of a private station. Thus nobly, indeed, did he earn, and unobtrusively has he enjoyed, the rewards he has received. But these should not have been granted to the exclusion of such great national benefactors as Watt and Symington. It is the philosopher who, from his closet, supplies the material of our victories, that, without which, generals do not command, nor statesmen direct, nor armies move. It was the Watts and Symingtons who enlarged, beyond conception, the resources of their country, and enabled that unexampled struggle to be maintained, which was closed by a series of the most brilliant achievements, raising Great Britain to an unrivalled eminence, both as a military and as a naval nation. The ablest political economists foresaw in two or three more hundred millions of debt, national bankruptcy, and ruin. Watt, Arkwright, Symington, and others, the scarcely known, the scorned inventors, enabled the country to borrow double the amount, and by consolidating more closely the interests of all, to bear, with less fear of disruption, the unexpected load.

Are we then to continue to judge so erroneously, to do nothing in life for the more retired man of genius; nothing for his memory at his death, whilst we rise with enthusiasm, and rend the air with our plaudits, at the mention of the more sparkling, yet less lasting deeds of the warrior? Surely we ought to inculcate a wiser judgment of excellence, and teach to bestow, with a juster hand, the sympathies of our countrymen, the rewards and honours of the nation.

It is the example of government that has taught us to distinguish so partially the objects for admiration, and it is there we must look for the first reformation. Gibbon, who abounds with noble sentiments, has, with a rare discrimination, exhorted the Spensers to consider the "Faery Queen" as the most precious jewel of their coronet. The deeds of Marlborough, brilliant as they were, are obscured by the brighter and more lasting, the imperishable radiance of the Queen of Song; the former, if not forgotten, are scarcely remembered or known, but in a few pages of history; whilst the "Faery Queen" is a household god. Justly, too, has Gibbon said, "It is a greater glory to science to develope and perfect mankind, than it is to enlarge the boundaries of the known universe." The soft influence of literature and the peaceful arts go hand in hand in civilizing man. The authors of these are the individuals we should be taught to consider as the real benefactors of their race. It is by their more general national encouragement, by the wider extension of their works, that they would in time take that station in the feelings and habits of all, and keep up that constant influence on our minds that would go, far beyond our present comprehension, to soften the bad tendencies of national ambition, and root out the delusions of false glory. The gifts of nature are the noblest prerogative of man; the recipients are of the salt of the earth; upon them Heaven has bestowed a patent of nobility no earthly potentate can equal, none can take away; one, whose monopoly is for no term of years, whose duration is eternity. It is these the noble and generous mind will reverence, far beyond the perishable gifts of fortune. The great geometrician and mechanician of Syracuse, Archimedes, and the Egyptian engineer, Hero of Alexandria, the inventor of the original high-pressure rotary engine, are still familiar names. Over the wide waste of centuries of barbarism, whilst countless millions have been swept to an obscure grave, the voices of the mighty dead are still alive, living in our sympathies. We know not, indeed, but that, in the economy of a superior intelligence, it may be permitted to the illustrious dead to derive a calm enjoyment from the praises

bestowed on their memories on earth. It is at least one of our strongest natural analogical convictions of a just futurity, that those who suffer so greatly here, as the instruments of Providence in bestowing blessings upon mankind, should hereafter receive a more benevolent consideration of their miseries and toils, than their fellow men have ever troubled themselves to bestow.

The present age boasts of possessing, beyond all former example, an enlarged consideration of the present, and a trustful philanthropy for the future interests of every class. Let us hope your appeal for tardy justice to poor Symington will evidence the truth; and not show it is but that sickly philanthropy which has only strength to blow its own trumpet, and nothing beyond; that shrinks when called upon for its useful display, and finds, in some miserable suggestion of a morbid caprice, an apology for not exerting its energies. Never could it find a more sacred object for its outpourings, for you have but asked for his memory and for his family, that bare justice each hopes for himself. Is there one among the millions of the civilized earth who has not participated in the death-labours of the ill-used Symington? Is there at least *one of his countrymen* who will acknowledge to himself, that he is of that number who is reaping what another has sown, who will not in return, for the many enjoyments and conveniences he has derived from his labours, lay his offering, hovever trifling, on the altar of neglected genius; one who died miserably poor, surrounded by the afflictions of his family,—an impoverished man, wasted by his labours for mankind; deserted by the country on which he had bestowed so rich a gift; a country who turned a deaf ear to his intreaties, refused his petitions for investigation into his claims on its gratitude! When we see the vast amount of wealth in this country, and scan the various distinctions of society, we could indeed look upon gold as but serving to swell the hollow and false mockeries of life, were we to find, in this class, no sympathy with your subject. When we compare what *was* Symington's state, with what theirs *is*, what he *did*, with what they *do*, we should then turn away with loathing and disgust at their false pretensions to estimation, and look upon the accumulation of wealth as the natural barrier to the exercise of the noblest and divinest feelings of our nature, as encouraging a false system of things, and fostering isolating sentiments, inimical to the true interests of society. Let them continue, as they have been, merciful stewards of that great wealth Providence has placed at their disposal. If the "lord of wantonness and ease" could but change places for a day with the poor and struggling inventive genius, he would never coldly turn his heart from the claims of their families on his protection. Could he but draw, as I have done, the curtain that divides their homes of indigence, from his, the ennui of luxury, he would be startled and shocked at the mental weariness and despondency seen there. He knows nothing of, he cannot appreciate, the unnumbered hours of misery, the toil, the want, the unexpected difficulties that rise to overwhelm him—hydra-headed, no sooner one overcome than it is succeeded by another, seeming to say you shall go no further—the fearful barriers to success, insurmountable to all but genius, to perseverance that knows no respite; the racking thought that tears the too feeble body; the fear of ridicule; the dread of being considered a mere schemer; the often-known alternations of hope and despondency; the wild exultation at partial success; and the sad reaction of depression, as a new difficulty comes in the way, wearing the mind and body to the dust; the acute sensibilities, stung by a thousand indignities;

> "The proud man's contumely;
> ———————the spurns
> That patient merit of the unworthy take;"

the dogmatism of ignorance; the scarce repressed smile of pity, or sneers of derision of the scientific and well-informed, whose mind is even with, not beyond his time, but whose judgment sweeps with it the mass; the depreciation of the envious; the "impossible" of the smatterer of science; the unprofitableness of the invention if successful; the dependant and wearying attendance on the rich to patronise what he does not, and cannot be made to understand; "to suffer all the stings and arrows of outrageous fortune," which seem indeed poured out of the quiver of some evil spirit, to dart into his soul, and stop him with a "sea of troubles."

These are *his* struggles for posterity,

and if in the end he prove the practicability of his invention, it often comes too late for him. He sees others, with unimpaired energies, vigorous, and pleased with the novelty, take it away from him, supported by the rich capitalist, who now sees it will do, and the inventor, shattered in constitution and ruined in pocket, at last dies broken-hearted. But if he live through it, and all is successful, he is immediately involved, as was poor Symington, in an endless litigation, for which he could not find means, to protect his inventions. Then meets him at every turn, "the oppressor's wrong, the law's delay, the insolence of office." Even the honour of the invention, is next denied him by these assassins of mind, or it is doubted if mankind were not better without it.*

Is the above an overdrawn picture? I wish sincerely it were; many, alas! who read it, will *feel* it is not up to the truth, for who but genius shall describe what only genius can feel? Nor must we forget, that if the inventor meet with the encouragement of a liberal patron, his feelings are scarcely less painful; there is then the noble anxiety lest his patron should lose his money. We speak not of those schemers who call themselves inventors; who, with not one original idea, review long-forgotten "improvements," prey upon and tire by their thousand useless schemes the public and capitalist, to the exclusion of the true genius who would otherwise meet an easier and more liberal reception. Even those who make in the end a competence or fortune by their inventions, would not suffer over again, for double the amount, all they have borne to attain success. Ask them the question, for their reply.

Let us hope, then, that those large engine manufacturers, whose magnificent establishments are evidence of their great wealth, the pride of Great Britain, will join the public with their names and influence in accomplishing your benevolent object on behalf of the family of the ill-requited Symington, the sole inventor of Steam Navigation.

I am, Sir, your obedient servant,

SCALPEL.

August 19, 1841.

* Mr. Watt was also drawn into a shameful, and all but ruinous expenditure. I should not like to name the sums he paid his solicitor for defending his rights—it would scarcely be credited. Of his claims to the invention, he writes to Dr. Black:—"We have been so beset by plagiaries, that if I had not a very good memory of my doing it, their impudent assertions would lead me to doubt whether I was the author of any improvements on the steam engine; and the ill will of those we have most essentially served, whether such improvements have not been highly prejudicial to the commonwealth."

## WOODEN TIRE RAILWAY WHEELS—VERIFICATION OF THE CLAIM OF MR. WILLIAM FROST, OF DERBY, TO THE INVENTION.

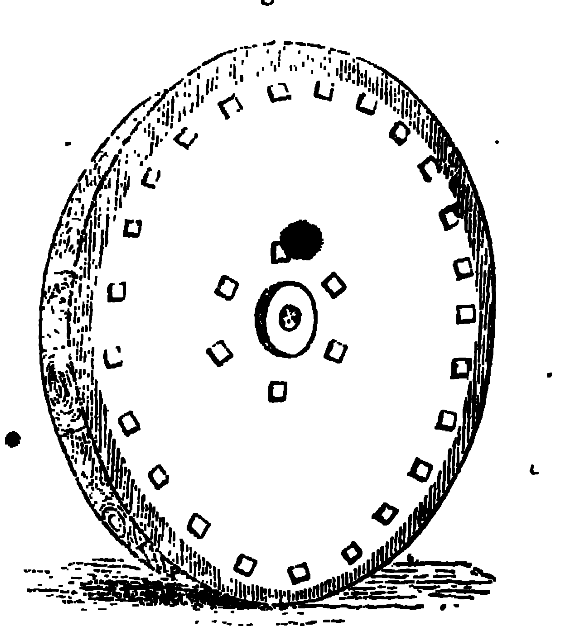
We published, some time back, (vol. xxxiii. p. 498,) a letter from a correspondent, (S. S. S.,) which claimed for Mr. William Frost, mill-wright, of Derby, the merit of first suggesting the construction of wheels for railway carriages with wooden tire—an invention recently patented by more than one individual, and very favourably spoken of by several railway engineers, who have made trial of it. From the letter of our correspondent, and from some documents which were sent along with it for our inspection, it appeared that Mr. Frost had, in 1830, sent a model of a wheel made in this manner to a friend in Manchester, *to be* submitted to the Directors of the Liverpool and Manchester Railway, but that it was doubtful whether it had ever been actually submitted to them. We observed, on this state of things, that "Mr. Booth, then, as now, the manager of the Company, could clear up this point, and would, we are sure, be very willing to do so." Application has accordingly been made to Mr. Booth, and with the good effect which we expected from the well-known urbanity and probity of that gentleman. A search having been made through the Company's store-house, the long-lost model has been found, and restored to Mr. Frost, with a letter from Mr. Booth, (22nd April, 1841,) in which he says:—

"Along with the model, in the same box, I found two letters relating to it, from yourself to this Company, dated 29th November, 1830, from Derby; and the other from Mr. William Fairbairn to myself, dated Manchester, 30th November, 1830. As the date of these letters marks the time when you submitted this model to Mr. Fairbairn and to this Company, now more than ten years since, I have thought you would like to have these letters in your possession."

From the letter of Mr. Frost, thus considerately returned to the writer, we shall make an extract or two, which will show how fully he had, at that early period, anticipated the wooden tire patentees of 1839-40, both in their views of the advantage of the substitution of wood for iron, and in their plans of construction.

"I am not at present [a word or two here obliterated in the MS.] kind of wood be the most proper for this purpose; but I should prefer good beech, and to be used end-ways. I have seen wood stand end-ways in mills for thickening cloths, &c., which induces me to think the wheels for your engines or carriages may be improved by it. The wood would be easily replaced when worn out. The wheels ought to be cast in two parts, which would considerably ease the contraction. The wrought-iron ring, which goes round the face of the wheel, must have leather or flannel between it and the wood. It is my opinion that iron hoops or wheels, and on an iron railway, cannot possibly continue for any length of time in a good state, when considered with the rapid motion of the carriage. * * * The wheel I have sent for your inspection will run easier for both passengers and carriages; and will be a considerable saving of expense. I think, on consideration, you will be inclined to give up the fine appearance of your wheel for the usefulness and safeness of the wheel I have now sent. * * * I was at Liverpool a short time ago, and went down and returned by your carriages, when I made my observations to several other gentlemen who were travelling at the same time, all of whom approved much of my plan."

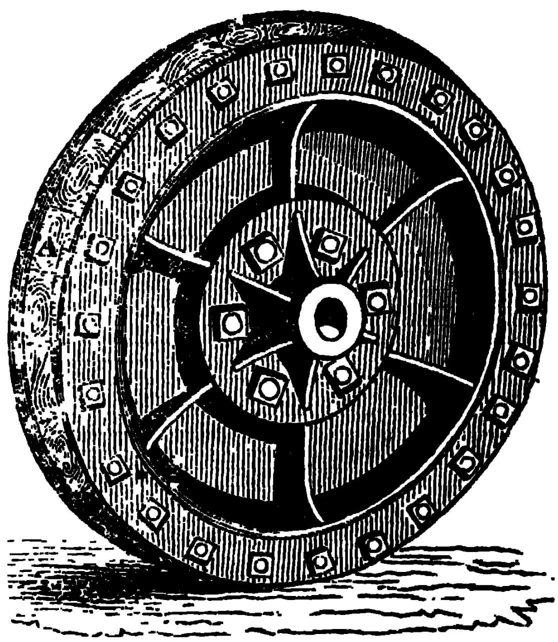
Fig. 1.



Mr. Fairbairn, in the letter (30th November, 1830) which accompanied Mr. Frost's to the Directors, says:—

"Mr. Frost is a plain practical man, and would, I have no doubt, be highly gratified by any suggestion that could be usefully applied. In mill-work, wood and iron gear is not only preferable, but equally durable with iron on the point of contact. How far Mr. Frost's plan would be applicable to railways is a question yet to be determined. The great risk would be, the wheel getting out of round.'"

Fig. 2.





Accompanying this notice are two engraved representations of Mr. Frost's model of 1830; fig. 1 being a back view; and fig. 2, a front view of it as seen in its complete state. A A are the pieces of wood which form the tire inserted in the groove of the "iron ring" mentioned in Mr. Frost's letter as "going round the face of the wheel," and which he proposed should have at the bottom of the groove a layer of leather or flannel, (instead of which he would probably now recommend *felt*,) for the wood to rest upon.

LUCY'S PATENT APPARATUS FOR EQUALISING THE MOTION OF A STEAM-ENGINE.

A paper has appeared in the *Encyclopædia Britannica*, vol. 20. pp. 663-4, which from the high character of that publication

obtains an authority which would not otherwise attach to it. The invention of the plan for equalising the motion of a Steam Engine without the use of a fly-wheel, is therein attributed to Mr. Buckle, of Soho, although I had previously obtained a patent for it. I wrote to the publishers, who referred me to Mr. John Scott Russell, the author of the article; but from him I have not been able to obtain the courtesy of a reply. Under these circumstances, I feel called upon to publish the following Letter:—

"Soho, July 16, 1835.

"Dear Sir,—I have named to Mr. Watt your wish that we should make the machinery you propose to attach to your engine, for the purpose of equalising its motion, and he agrees to do so without going into the consideration of the scheme, on the understanding that we take no responsibility for its success, which, with whatever credit may attach to it, must belong to you. We can only say further, that if you determine to have it made by us, we shall do all in our power to make it answer your views, and to render it as little expensive as we can.

"I remain, dear sir, yours truly,
("for Boulton, Watt, and Co.,)
"GILBERT HAMILTON.

"Mr. William Lucy,
"Birmingham."

Messrs. Boulton, Watt, and Co. employed Mr. Buckle "to make it answer my views," and I therefore feel that they ought to have protected me from the unwarrantable claim of that person to be the inventor of a plan which they had acknowledged to be entirely mine.

"WILLIAM LUCY.

Birmingham, August 20, 1841.

## ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

**** Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for the purpose.*

FRANCIS SLEDDON, JUN., OF PRESTON, LANCASHIRE, MACHINE-MAKER, *for certain improvements in machinery or apparatus for roving, slubbing, and spinning cotton, and other fibrous substances.* Petty Bag Office, August 2, 1841.

The first improvement consists of an apparatus for driving and regulating the winding on, or taking-up motions, instead of the conical drum now commonly employed for that purpose. The place of the conical drum is occupied by an upright shaft driven in the same manner, having at its lower end a spur-wheel, which conveys its motion by means of a long pinion to a small spur-wheel on a second upright shaft, which gears into a similar wheel on another vertical shaft. The two latter shafts are each furnished at their upper ends with a friction roller covered with leather, and are mounted in a pair of clip levers, their lower extremities passing through ball and socket swivels in a foundation plate; the clip levers are jointed in the middle, and have their fulcrum bearing upon an upright pillar, supported by a circular rack capable of moving up or down the pillar. The outer extremities of the levers are forced apart by a spring wedge placed in a box, and slidden out as required, so as to force the other extremities of the levers which carry the rollers inward, and cause the rollers to bear with the requisite degree of friction against each side of a surface plate, mounted upon the main driving shaft, and connected with the gearing of the "jack in the box" motion by a long boss. By this means the usual rotary motion is given to the spindles and bobbins. As the bobbin becomes filled with yarn, its diameter increases, and it becomes necessary to impart a varying speed to the winding on or taking up apparatus: which is accomplished by shifting the friction rollers from the centre towards the periphery of the surface-plate, by which means a gradually diminishing speed of the plate will be readily obtained, and *vice versa.*

This shifting of the friction rollers, constitutes the second improvement, and is effected as follows:—To the side of the surface plate farthest from the "jack in the box," a pinion is attached, which drives the traverse motion in the usual manner, and gearing into a spur-wheel, drives another pinion which, by means of a carrier wheel drives a spur-wheel upon one end of a shaft having at its other end a mangle pinion driving a mangle wheel. As this shaft is shifted sideways by the changing of the mangle pinion upon the mangle wheel, the alteration in the position of the friction rollers upon the surface plate is simultaneously effected, thereby imparting the requisite winding on or taking-up motion.

A third improvement consists in placing a spur-wheel in connection with the circular rack for the purpose of obtaining the requisite motion for tapering the ends of the bobbins, if necessary.

The claim is to the novel construction and arrangement of mechanism or apparatus, for the purposes of driving and regulating the ordinary winding on or taking-up motions, and also the traverse and copping motions, in roving, slubbing, and spinning machinery, by means of the combination of the friction

rollers or bowls with the surface plate; and the apparatus in combination therewith.

WILLIAM RYDER, OF BOLTON, LANCASHIRE, ROLLER AND SPINDLE-MAKER, *for certain improved apparatus for forging, moulding or forming spindles, rollers, bolts, and various other like articles in metal.* Roll's Chapel Office, August 8, 1841.

Upon pedestals at the upper part of a strong iron frame-work, a driving shaft revolves, having at one end a fly-wheel, and at the other end a fast and loose pulley; upon this shaft a series of eccentrics are fixed, which work upon vibrating bed or cradle pieces, bearing at their lower extremities upon the upper ends of a series of bars. This series of bars are alternately forced down by the revolution of the eccentrics, and raised up again by springs, performing a rapid reciprocating motion, and acting as the striking hammers of the machine. A similar series of bars, forming the anvils, are also supported immediately below the former, their lower extremities bearing upon elastic beds to obviate any sudden concussion between the hammers and the anvils. Dies, swages, or hammers being attached to the extremities of the upper and lower bars, the rod or bar to be operated upon is made red hot and placed between them, its outer end being supported on an adjustable rest, the rod being turned by the operator, is rapidly forged into the required shape by the reciprocating action of the machinery.

The claim is to the improved apparatus, and especially the mechanical combination of the eccentric with the cradle piece, and the top and bottom punch-bars or swage-holders, with their swages; also the use or employment of a spring, for the purpose of lifting or keeping up the top punch and cradle-piece against the eccentric, and the elastic or spring bed, when employed for these purposes, in whatever manner the construction, form, or dimensions of the apparatus may be modified or varied.

JOHN CARTWRIGHT, OF LOUGHBOROUGH, LEICESTER, MANUFACTURER OF HOSIERY, HENRY WARNER, OF THE SAME PLACE, MANUFACTURER, AND JOSEPH HAYWOOD, OF THE SAME PLACE, FRAMESMITH, *for improvements upon machinery commonly called stocking-frames, or frame-work knitting machinery.* Roll's Chapel Office, August 4, 1841.

There are six different improvements set forth in this specification, the descriptions of which occupy 21 skins of parchment, and are accompanied by 11 sheets of explanatory drawings, without which it is difficult to make them intelligible.

The first improvement consists in dispensing with the carriage, by which the jacks and their appurtenances are supported, and affixing the jack-bar to the sinker frame: suitable pulling-up springs being used to counterbalance the additional weight with which the sinker frame is thus loaded. This improvement can be used singly, or in combination with some of the following improvements:—

The second improvement consists in affixing the nibs and catches of the jack-sinkers to the front ends of the jacks, and doing away with the usual moveable joints for suspending the sinkers from. Also in placing all the lower parts of the jack-sinkers in a row with the lead-sinkers; the complete row, containing a long and short sinker, forming what the patentees call "hand-bar sinkers."

The third improvement consists in combining with the 1st and 2nd—or with the 1st, 2nd, 4th and 5th improvements, the use of jacks without tails, the jack wire being at the hinder end of the jacks, and the slur acting over the jacks near their front ends, as well as the slea for guiding them and keeping them at proper distances from each other.

The fourth improvement is combined with the 1st and 2nd, and consists in attaching pieces of metal laterally on the sides of the long sinkers of the "hand-bar sinkers," so that these pieces of metal will be supported by the upper ends of the long sinkers over the needles, so as to act like a presser bar, and close down the bearded points of the needles.

The fifth improvement is combined with the 1st, for the purpose of doing away with the spindle-bar arms, spindle-bar and main-spring. The centre line of the top joints, on which the sinker frame is hung, is rendered an immoveable horizontal-centre line, which permits the sinker frame to swing backward and forward, but prevents it from ascending or descending. The needle-bar is also mounted on pivots, the centre line of which is an immoveable horizontal line parallel to the former.

The sixth improvement is a substitute for the 4th, and consists in interposing detached pieces of metal in the spaces between the "hand-bar sinkers," which act as if they were affixed thereto, being held in leads which are screwed to the sinker-bar.

WILLIAM HENRY FOX TALBOT, ESQ., of LACOCK-ABBEY, WILTS, *for improvements in obtaining pictures or representations of objects.* Enrolment Office, August 8, 1841.

The best and smoothest writing paper is washed on one side with a camel hair brush dipped in a solution of 100 grains of crystallised nitrate of silver in six ounces of distilled water. The side being marked, to know it again, the paper is dried before a distant fire, or in the dark, after which it is dipped for a minute or two in a solution of 500 grains of iodide of potassium in a pint of

water; the paper is then dipped in water and dried. It is now called iodised paper, and kept in a portfolio for use. Immediately before using, this iodised paper is washed on the marked side with the following mixture: 100 grains of nitrate of silver are dissolved in 2 ounces of distilled water, to which solution one-fourth of its volume of acetic acid is added. A saturated solution of crystallised gallic acid, or the tincture of galls is mixed with the foregoing in equal volumes, forming gallo-nitrate of silver. After being washed with this mixture, the paper is dipped into water; it is then dried lightly with blotting paper, and finished by a distant fire. These operations should be performed by candle-light.

This paper, which the inventor calls "Calotype-paper," is used as follows:—A sheet of the paper is placed in a camera obscura, so as to receive the image formed in the focus of the lens. If the object is very bright, or the paper is exposed a sufficient time, a sensible image will appear on the paper when removed from the camera obscura. But when the object is "invisible or dimly seen," it is brought out in the following manner:—The paper is washed over with the gallo-nitrate of silver, and held before a gentle fire until the picture is sufficiently distinct, which is then fixed in the following manner: The paper is first dipped into water and partly dried with blotting-paper, after which it is washed with a solution of 100 grains of bromide of potassium in 8 or 10 ounces of water; after which, the picture is again washed with water and dried. In the picture thus obtained, the lights and shades are reversed, but another being taken from it restores their natural position.

For this purpose a second sheet of calotype paper—or the patentee prefers using common photographic paper—is placed in contact with the picture, a board placed beneath and a sheet of glass above them, pressed into close contact by screws. On placing them in the sunshine for a short time, a picture with the lights and shadows in their natural position is produced on the second paper, which is to be fixed as before directed. After frequent copying in this manner a calotype picture sometimes becomes faint, to prevent which, it is to be washed by candle-light with the gallo-nitrate of silver.

A second improvement consists in a mode of obtaining positive calotype pictures, *i. e.*, with the lights and shades in their natural position—by a single operation. For this purpose a sheet of calotype paper is exposed to the day-light until its surface is slightly browned; it is then dipped into the solution of iodide of potassium, by which the browning is apparently removed. On being taken out of this solution, the paper is dipped in water and slightly dried; it is then placed in the camera obscura and pointed at an object for five or ten minutes. The paper is then removed, washed with gallo-nitrate of silver, and warmed, when a positive image will be produced.

A third improvement consists in producing photogenic images on copper, a plate of polished copper is exposed to the vapour of iodine, or bromine, or the two combined, or of either of them combined with chlorine; or the copper is dipped into a solution of some of these substances in alcohol, ether, &c. On this copper a photogenic image is formed in the usual manner, and exposed to the vapour of sulphuretted hydrogen, when a different colour is produced on those parts of the copper which have been acted upon by the light to that which appears on the parts not so exposed; consequently, a permament coloured photogenic image is obtained, which is not injured by further exposure to light.

A fourth improvement is as follows:—A thin coating of silver is given to a plate of steel or other suitable metal, which is made sensitive to light in the usual way; the plate is then placed horizontally and covered with a solution of acetate of lead, through which, a galvanic current being made to pass, a coloured film is precipitated on the picture.

A fifth improvement consists in a method of obtaining very thin surfaces of silver for photographic processes. A very thin plate of copper is first precipitated on a polished plate of metal by the electrotype process, and a sheet of card is cemented to the back of the layer; when dry, the card and copper are removed, and the copper silvered by immersion in a suitable solution of that metal.

A sixth and last improvement is in transferring photogenic pictures from paper to metal. For this purpose the surface is rendered sensitive to light, and the picture placed upon it with a plate of glass in front, kept in contact by screws and exposed to the sun's rays when the required transfer is effected, which is to be afterwards fixed, and otherwise treated according to the effect required.

Thomas Griffiths of Birmingham, Tin-plate Worker, *for certain improvements in such dish covers as are made with iron covered with tin.* Enrolment Office, August 8, 1841.

These improvements are three-fold; the first consists in forging the cover out of one piece of rolled iron plate, which is stamped so deeply concave in a stamping machine, as to form the upright sides, and the rim at the base of the cover, as well as the top or dome; the cover is then tinned, and afterwards finished off.

The second improvement consists in form-

ing the cover out of two pieces of iron plate, without any vertical joints: the one piece forming the dome or top, and the other the lower part or base of the cover.

The third improvement consists in swaging up the mouldings around the lower part of the cover, by means of revolving wheels or rollers, which are turned round continuously in one direction.

CHARLES GREEN, OF BIRMINGHAM, GOLD PLATER, *for improvements in the manufacture of brass and copper tubes.* Enrolment Office, August 8, 1841.

Mr. Green took out a patent in 1838, for improvements in the above manufacture, which consisted in casting short thick tubes, into which solid cylindrical mandrils were inserted; by repeatedly drawing and annealing these tubes, they were extended to the required length and thickness, being made without any joint or seam.

The first of the present improvements, consists in casting the tube with an internal circular rim at one end, which forms a stop to a corresponding shoulder on the mandril.

A second improvement consists in a more convenient mode of holding the mandril; for which purpose, a portion near each end of the mandril is reduced in size, leaving a projecting head at the end of the mandril. This head is received into a cavity in the holder, and secured by a steel key, which is inserted into the holder across the continuation of the cavity, which prevents the mandril from being drawn out of the holder.

A third improvement consists in making brass or copper tubes to be engraved for calico or other printing; these tubes are cast with a nib projecting from their interior, and extending longitudinally from one end of the tube to the other, by which they are fixed to the axis. These tubes, like the former, are made without seam or joint, and are brought to the proper size by repeated drawings.

A fourth improvement, consists of a draw-bench for inserting the mandril of the tube, which is very similar to the holder described above.

WILLIAM WIGSTON, OF SALFORD, LANCASHIRE, ENGINEER, *for a new apparatus for the purpose of conveying signals or telegraphic communications.* Enrolment Office, August 8, 1841.

This is another of the numerous class of contrivances to which the frequency of railway accidents at the beginning of the present year gave rise, and for the future prevention of which, much ingenuity and skill has, we fear, been most unprofitably employed.

The present apparatus consists of an upright frame, in the lower part of which are two double cylinders of a peculiar construction. The inner cylinders are much smaller than the outer ones, to which each is attached by some elastic air-tight medium, one end of which is fastened round the top of the outer cylinder, the other round the bottom of the inner cylinder, so that the latter operates like a piston when moving perpendicularly. When the inner cylinder rises, the elastic connecting tube rolls over into the upper part of the outer cylinder, and the air contained in it is expelled, and is also admitted by a tube at the bottom of the same. The inner cylinders are counterbalanced by weights, and are attached to a couple of rods elbowed at the upper end, so as to support two central shafts, the upper ends of which carry, the one a circular, the other a lozenge-shaped signal. The shaft which supports the latter, passes through the centre of the shaft of the circle, and both shafts are provided with an arm carrying a small pulley. These pulleys move in guiding grooves, so formed, that the elevation, or depression of the pulleys turns the central shafts one-fourth of a revolution at every traverse.

A perpendicular shaft, carrying a cross-head, is placed between the cylinders, and attached at its lower end to a long horizontal lever, which is connected with a series of levers lying alongside the rails; on the passing of a train of carriages, the wheels acting on these levers depress the horizontal lever, and with it the perpendicular shaft, which has otherwise a constant tendency to rise given to it by a balance-weight. The cross-head intersects the upright rods of the double cylinders, which rods are provided with rings or sliding pieces, supported on spiral springs that proceed to the bottom of the inner cylinders.

This signal apparatus is to be placed at regular distances along a line of railway, and each cylinder connected with that which is next to it at the two adjacent stations, by pipes; the apparatus is then adjusted, so that each pair of cylinders thus connected shall contain a sufficient quantity of air to keep one inner cylinder in an elevated position, while the other is depressed. On a train passing one of these stations, it depresses the levers which causes the cross-head to descend and force the second cylinder downwards, and expels the air, which, passing through the connecting pipes, elevates the first inner cylinder of the next station in advance, where the lozenge-shaped signal is turned one-fourth of a revolution, and presents its edge to the line: the circular signal at the station passed, being at the same time placed in a corresponding position.

On reaching the next signal station, the passing of the train produces a similar action, restoring the former signals to their original position, and acting on those at the station

in advance. By this means the progress of a train from station to station is distinctly marked, and should any obstruction or accident occur on the line, the position of the signals informs the driver of an approaching train of the circumstance. In addition to these signals, a bell is also provided at each station, which commences ringing on the passing of a train, and continues to do so till it has passed the next adjacent station. Several modifications of the apparatus are shown and described.

The claim is to the combination of parts of which the apparatus is composed, and particularly the construction and arrangement of the cylinders for the purpose of conveying signals or telegraphic communications, together with all modifications of the same.

THOMAS FULLER, OF SALFORD, LANCASHIRE, MACHINE-MAKER, *for certain improvements in machinery, or apparatus for combing or preparing wool, or other fibrous substances.* Petty Bag Office, August 8, 1841.

These improvements apply to the "double circular wool-combing machine," patented by Mr. John Platt, in 1827. In that machine the teeth of the circular combs were set parallel, or nearly parallel, to the axes of the comb-wheels; the present improvement consists in setting the teeth at an angle of about 150°.

The second improvement consists in placing the usual drawing apparatus of the old machine at an angle of about 40° with the horizon, so as to enable it to draw off the fibres of the material which has been combed from the teeth of the comb-wheel, more effectually than heretofore.

The claim is, 1. To the setting the teeth, pins, points, or broaches, of circular combs, in the face of the comb-wheels, in positions forming acute angles with the axes of those wheels. 2. To the adapting the position of the drawing-rollers to a suitable angle for drawing off the slivers from the comb-wheels as described.



## LIST OF DESIGNS REGISTERED BETWEEN JULY 28TH AND AUGUST 24TH.

| Date of Registration. | Number on the Register. | Registered Proprietors' Names. | Subject of Design. | Time for which protection is granted. |
|---|---|---|---|---|
| 1841. | | | | |
| July 28 | 757 | W. Wilson | Trowser-strap | 3 years. |
| 29 | 758 | G. Barnett | Waistcoat band | 1 |
| " | 759 | J. Walton | Table knife | 3 |
| Aug. 2 | 760,1 | H. Longdon and Son | Fender | 3 |
| " | 762 | J. H. Hood | Portfolio | 1 |
| 4 | 763,4 | S. Ackroyd | Fender | 3 |
| " | 765 | Henderson and Co. | Carpet | 1 |
| " | 766 | G. Harris and J. D. Cumming | Ditto | 1 |
| 5 | 767,72 | H. N. Turner and Co. | Stained paper | 1 |
| 9 | 773 | J. and J. Walker | Cautoon | 1 |
| " | 774 | Stoddart and Boycot | Carpet | 1 |
| 10 | 775 | B. Tyler | Leaf-holder | 3 |
| 11 | 776 | J. Duncalfe and Son | Tray | 3 |
| " | 777 | Mc Michaels and Grierson | Carpet | 1 |
| " | 778 | Stoddart and Boycot | Ditto | 1 |
| 12 | 779 | W. Cribb | Label | 1 |
| " | 780 | J. Cookes | Stopper cap | 3 |
| 13 | 781,3 | J. and J. Walker | Gambroon | 1 |
| 16 | 784 | G. Jackson and Sons | Picture frame | 3 |
| 17 | 785 | G. Rigby | Label | 1 |
| 18 | 786 | Welch and Margetson | Strap fastening | 3 |
| 19 | 787 | J. P. Whitehead | Tray | 3 |
| 20 | 788 | J. Duncalfe and Son | Ditto | 3 |
| " | 789 | Thomas Collins | Penholder | 1 |
| " | 790 | H. B. Wright | Ditto | 3 |
| 23 | 791 | T. Wharton | Miniature frame back | 3 |
| 24 | 792 | E. H. Barwell | Stove | 3 |

## LIST OF ENGLISH PATENTS GRANTED BETWEEN THE 28TH OF JULY AND THE 24TH OF AUGUST, 1841.

Joseph Ratcliffe, of Birmingham, manufacturer, for certain improvements in the construction and manufacture of hinges for hanging and closing doors. August 4; six months. (Being a communication.)

Owen Williams, of Basing Lane, London, engi-

neer, for improvements in propelling vessels. August 4; six months.

John Lee, of Newcastle-upon-Tyne, manufacturing chemist, for improvements in the manufacture of chlorine. August 4; six months.

James Warren, of Montague Terrace, Mile End Road, for an improved machine for making screws. August 4; six months.

Stopford Thomas Jones, Tavistock-place, Russell Square, gent., for certain improvements in machinery for propelling vessels by steam or other power. August 4; six months.

William Craig, engineer, Robert Jarvie, ropemaker, and James Jarvie, rope-maker, all of Glasgow, in the kingdom of Scotland, for certain improvements in machinery for preparing and spinning hemp, flax, wool, and other fibrous materials. August 11; six months.

Samuel Brown, of Gravel-lane, Southwark, engineer, for improvements in the manufacture of metallic casks or vessels, and in tinning or zincking metal for such and other purposes. August 11; six months.

John Seaward, and Samuel Seaward, of the Canal Iron Works, Poplar, engineers, for certain improvements in steam engines. August 13; six months.

William Hale, engineer, and Edward Dell, merchant, both of Woolwich, for improvements in cases and Magazines for gun-powder. August 13; six months.

John Harvig, of the Strand, gentleman, and Felix Moreau, of Holywell-street, Millbank, sculptor, for a new and improved mode or process of cutting or working cork for various purposes. August 21; six months.

John Harvig, of the Strand, gentleman, and Felix Moreau, of Holywell-street, Millbank, sculptor, for a new or improved process or processes for sculp- [illegible] l polishing stone, metals, and other substances. August 21; six months.

John Thomas Carr, of the town and county of Newcastle-upon-Tyne, for improvements in steam-engines. (Being a communication.) August 21; six months.

George Hickes, of Manchester, agent, for an improved machine for cleaning or freeing wool, and other fibrous materials, of burs and other extraneous substances. August 21; six months.

Charles de Bergue, of Broad-street, London, merchant, for improvements in axletrees and axletree boxes. (Being a communication.) August 21; six months.

Frederick de Moleyns, of Cheltenham, gentleman, for certain improvements in the production or development of electricity, and the application of electricity for the obtainment of illumination and motion. August 21; six months.

William Walker Jenkins, of Gred, in the county of Worcester, manufacturer, for certain improvements in machines for the making of pins, and sticking the same into paper. August 27; six months.

Edmund Morewood, of Highgate, Middlesex, gentleman, for an improved mode of preserving iron and other metals from oxidation or rust. (Being a communication.) August 27; six months.

Miles Berry, of Chancery-lane, civil engineer, for certain improvements in the means and apparatus for obtaining motive power, and rendering more effective the use of known agents of motion. (Being a communication.) August 27; six months.

Samuel Hardman, of Farnworth, near Lancaster, spindle and fly-maker, for certain improvements in machinery or apparatus for roving and slubbing cotton and other fibrous substances. August 27; six months.

Thomas Chambers and Francis Mark Franklin, of Lawrence-lane, London, and Charles Rowley, of Birmingham, button manufacturer, for improvements in the manufacture of buttons and fastenings for wearing apparel. August 27; six months.

## LIST OF SCOTCH PATENTS GRANTED BETWEEN JULY 22ND AND AUGUST 22ND, 1841.

James Molyneux, of Preston, Lancaster, linendraper, for an improved mode of dressing flax and tow. Sealed, July 28, 1841.

Edward Foard, of Queen's Head-lane, Islington, Middlesex, machinist, for an improved method, or improved methods of supplying fuel to the fireplaces or grates of steam-engine boilers, brewers' coppers, and other furnaces; as well, also, to the fire-places employed in domestic purposes; and generally to the supplying of fuel to furnaces or fire-places in such a manner, as to consume the smoke generally produced in such furnaces or fireplaces. Sealed, July 28, 1841.

William Crofts, of Radford Works, near Nottingham, lace-manufacturer, for improvements in the manufacture of figured or ornamented bobbin-net, or twist lace, and other fabrics. Sealed, July 28, 1841.

James Shanks, of St. Helen's, Lancashire, chemist, for improvements in the manufacture of carbonate of soda. Sealed, July 28, 1841.

Richard Beard, of Egremont-place, New-road, Middlesex, gentleman, for improvements in the means and apparatus to be employed for taking or obtaining likenesses and representations of nature, and of drawings, and other objects. (Being a communication from abroad.) Sealed, July 28, 1841.

John Brumwell Gregson, of Newcastle-upon-Tyne, Northumberland, soda-water manufacturer, for improvements in pigments, and in the preparation of the sulphates of iron and magnesia. Sealed, July 29, 1841.

James Lee, of Newcastle-upon-Tyne, Northumberland, manufacturing chemist, for improvements in the manufacture of chlorine. Sealed, August 3, 1841.

Moses Poole, of Lincoln's-inn, Middlesex, gent., for improvements in tanning, and dressing or currying of skins. (Being a communication from abroad.) Sealed, August 3, 1841.

Thomas Spencer, of Liverpool, Lancaster, carver and gilder, for an improvement or improvements in the manufacture of picture and other frames, and cornices, applicable also to other useful and decorative purposes. Sealed, August 4, 1841.

John Haughton, of Liverpool, clerk, for improvements in the method of affixing certain labels. Sealed, August 11, 1841.

Thomas Carr, of the town and county of Newcastle-upon-Tyne, being a communication from abroad, for improvements in steam-engines. Sealed, August 18, 1841.

Ezekiel Jones, of Stockport, Cheshire, mechanic, for certain improvements in machinery for preparing slubbing, roving, spinning, and doubling cotton, silk, wool, worsted, flax, and other fibrous substances. Sealed, August 20, 1841.

*The Removal of the Sunderland Light-house.*—[See No. 934, p. 7.]—The stone-work has been cut out at the base, and a railway and carriage erected, on which the light-house now stands; it was moved by screw power a distance of 21 feet to the north on Monday, in which situation it will remain for some time, till the railway is reversed, when it will be removed to its new site, at the east end of the north pier.—*Newcastle Chronicle.*

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# Mechanics' Magazine,

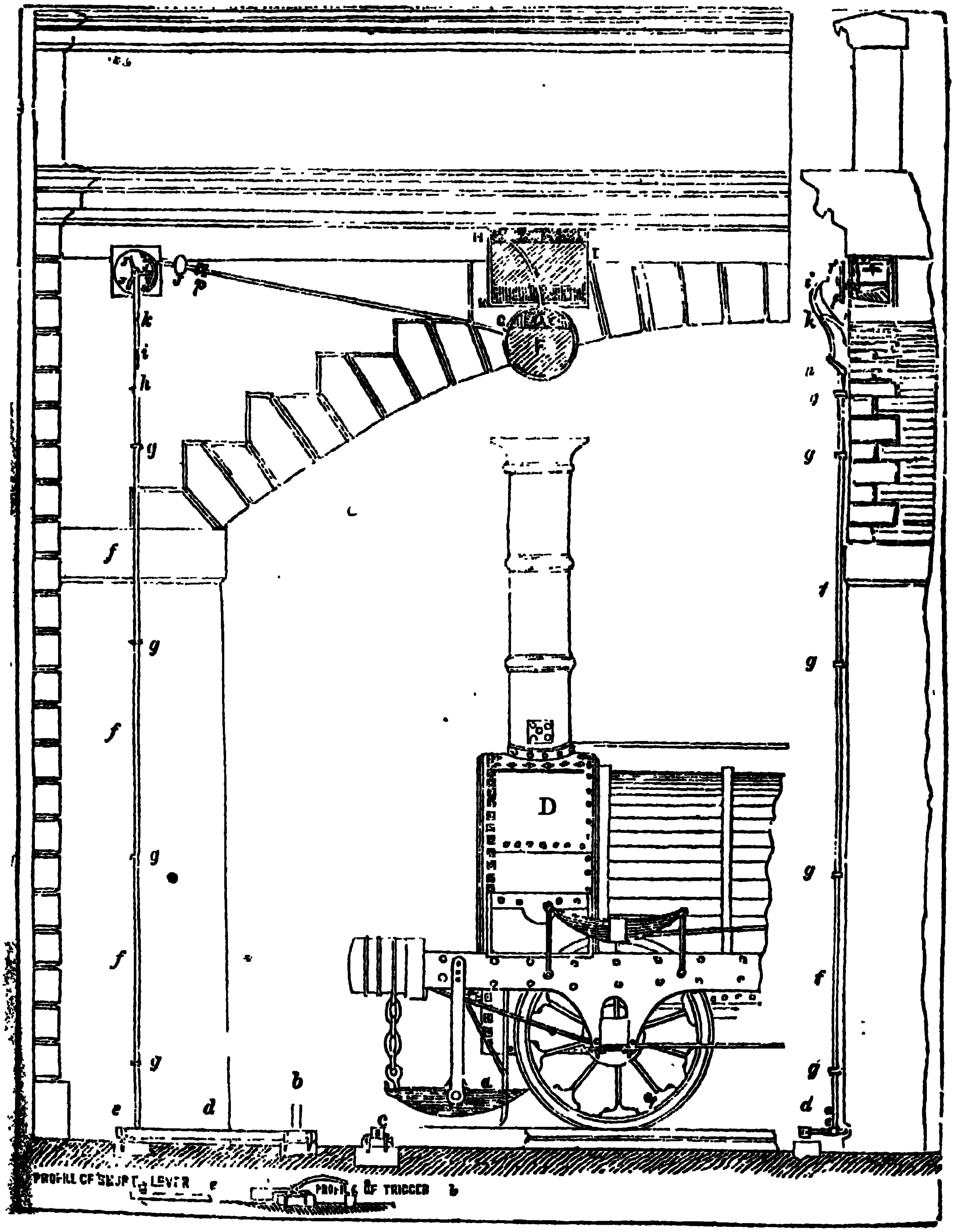
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 943.] SATURDAY, SEPTEMBER 4, 1841. [Price 3*d.*

Edited, Printed and Published by J. C. Robertson, No. 166, Fleet-street.


## CURTIS'S SELF-ACTING SIGNAL APPARATUS.

Fig. 1.



## DESCRIPTION OF AN IMPROVED METHOD OF MAKING SIGNALS BY SELF-ACTING APPARATUS, TO BE USED ON RAILWAYS FOR OBVIATING COLLISIONS, ETC.—BY CHARLES BERWICK CURTIS, ESQ.

We duly noticed Mr. Curtis's specification at the time of its enrolment (vide our 939th Number,) but as that notice was necessarily brief, and imperfect for want of the explanatory drawings necessary for making it intelligible, we now return to the subject for the purpose of explaining more clearly the nature of this invention, which seems well adapted to answer the purpose intended; and if applied to any line of railway, to go very far towards preventing those fearful accidents, the frequency of which led to the designing of this, and several other somewhat similar contrivances, which have been recorded in our patent offices within the last six months.

This patent was granted on the 19th of January 1841, and the following particulars, taken from a pamphlet recently published by Mr. Curtis, will, with the drawings annexed, show the nature of his invention.

The methods comprised in the patent, are intended to be carried into effect by means of self-acting apparatus; the distinguishing character of which is, that at every time when a train travels along that part of the railway, where any such apparatus is situated, so as to pass by that apparatus, the same will exhibit a signal immediately on the train so passing by, and will continue to exhibit the signal without alteration in its appearance, so long as there will not have been sufficient time for the said train to have advanced far enough along the line beyond the apparatus, to permit of any succeeding train to follow after the said first-mentioned train, and the signal so exhibited will give information to the driver of any such succeeding train which may happen to come up in sight of the apparatus that he is to stop and not proceed; and which apparatus, after having so exhibited such signal, then, in due time, begins to withdraw the same gradually from full view by the motion of suitable wheelwork, and whilst so withdrawing, the said signal is caused to change its appearance in some marked manner, in order to give information to the driver of any train which may happen to arrive within sight of the apparatus whilst the signal is so exhibiting in its changed appearance, that such train may proceed slowly, but not at full speed; and the said apparatus, also, after having so exhibited the signal in its said changed appearance, wholly withdraws the signal from view, or withdraws the same into an inactive or resting position, and then the motion or action of the apparatus ceases; and it continues in its inactive or resting position until another succeeding train passes, and the signal in its said inactive or resting position, serves to inform the driver of any such succeeding train which may happen to arrive in sight of the apparatus when in that state, that he may proceed at full speed without risk of collision with the preceding train.

Fig. 1, on our front page, represents an apparatus fixed to a bridge which crosses the line, or at the entrance of a tunnel.

C C, line of railway; D, locomotive engine, to show the manner in which the action is communicated to the apparatus.

*a*, piece of wood attached to each side of the engine.

*b*, curved lever-arm, or trigger, or camb, fixed upon a horizontal axis (*d*,) which extends sideways, in order to reach towards the side pier of the bridge, which axis is sustained by suitable bearings set upon a sleeper of wood or stone.

*e*, a short lever extending horizontally from the axis (*d*) towards the face of the pier.

*f*, upright rod, joined to the end of lever (*e*,) and carried up the face of the pier.

*g g*, guides fixed to secure the rod (*f*.)

*h*, an oblique link, connecting the upper end of the rod (*f*) with the lower end of the lever (*i*,) being bent in the form of (*i*) a goose-neck, whereof the fulcrum is sustained by a centre-pin in a bearing-bracket (*k*) fixed in the wall.

*j*, three arms radiating from the centre arbor of an apparatus of wheelwork, with liberty to slide backwards and forwards thereupon, and kept out to its working position by means of a

curled spring; the arms are furnished at the extremities and on the outer face with short pins.

H I K, box or screen fixed on the face of the bridge, partly or wholly over the arch, placed in a horizontal line, or nearly so, with the centre arbor of the three arms *(j)*, projecting a short distance from the wall; coloured in three compartments, black at top, green in the middle, and red at the bottom, the red and black being about one quarter each of the surface, and the green taking up the intermediate space.

F is a signal at the end of a lever *n*, *p*, G, having its bearing at *p*. The signal consists of a rim of iron, enclosing two pieces of coloured glass, the top piece being red, and forming about one-third of the surface, and the lower part being green, and forming the other part. On the top of the rim, a round plate or pointer, painted white, is fixed by a strong wire, cranked so that it shall work freely through a groove cut in the front of the box H I K, and traversing over the face of the box.

G is the end of the lever to which the signal F is fixed. J, a counterpoise to balance the signal F. L, the round plate, or pointer. N, the position of the lamp for night-signals, in front of which signal F falls.

*p*, the bearing or fulcrum upon which the lever *n*, *p*, G works. *n* is the point of lever (*n*, *p*, G) acted upon by the pin upon the three arms *(j)*. *r*, the güide to secure the end of the lever. *s*, the stop for the end of the lever (*n*, *p*, G).

The action is as follows:—

Upon an engine passing the spot where such apparatus is fixed, the piece of wood, *a*, strikes in a glancing direction the trigger or camb *b*, which depresses it about 1¼ inch, turning by that depression the arm *d*, and raising the short lever *e*, which forces up the rod *f*, and by means of the oblique link *h*, drives out the lower end of the bent rod or gooseneck *i*, which drives the head of the same against the centre of the three arms *j*, and presses them back upon the arbor of the wheelwork. The end of the lever *n*, *p*, G, is held in its resting position, or behind the screen or box by one of the pins at the extremity of the three arms *j*. As soon, therefore, as the arm is pressed in, the pin is withdrawn from its hold, and the lever *n*, *p*, G, being free, falls by its own weight, and exhibits the glass-field signal F, below the screen, in front of the lamp at night, and draws down the white-painted plate or pointer from the compartment painted black, to the front of the red compartment at the lower part of the screen.

The wheelwork now begins to be in action, and that arm of the arms, (*j*,) which is next in rotation, moves slowly round, without at first having any intercourse with the lever, *n*, *p*, G; at length it arrives at the point of contact, and then commences to press down the short end of the lever, and the signal F rises gradually behind the boxing, withdrawing the red portion of the signal from before the lamp, and carrying the pointer over the red compartment of the screen, or upon the green compartment, showing by degrees an altered appearance of the signal during the day, or a green light during the night, and the white plate or pointer continues to traverse the green compartment, and the signal diminishes at the upper *limb*, still showing for night a green light until the signal arrives at its resting place, carrying the white plate or pointer on upon the black compartment, and then being withdrawn entirely from view, discloses the lamp in its regular white colour. The action of the wheel-work is now arrested, and remains at rest till the passing of the next train.

The notice which the apparatus exhibits to drivers of trains is as follows: the signal, after being released by a preceding train, remains exhibited motionless for about 3½ minutes, and it consumes about half-a-minute for the wheel-work, when it begins to operate, to raise the lever so far up as to withdraw the red portion of the signal, or conceal one-third of its area, and to raise the white plate or pointer from the red compartment on upon the green. A driver, therefore, arriving at the spot, and observing the whole of the signal visible, and the pointer upon the red, or the red light at night, is informed that the preceding train has passed less than four minutes a-head of him, and that it is dangerous to proceed. If upon his arrival he observes that one-third of the signal is withdrawn into the screen, and the

pointer upon the green, or the green light at night, he is informed that the preceding train is more than four minutes, but under ten minutes a-head, and that he must check his speed, and go cautiously; but, if on arriving at the spot he finds that there is no signal visible, (the pointer being on the black compartment, or a white light at night,) he may drive at his usual speed without risk.*

Fig. 2.

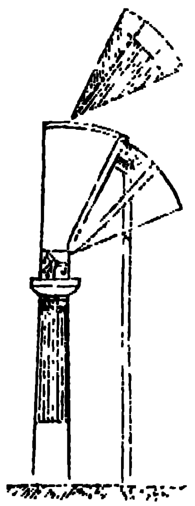


Fig. 2, represents another kind of apparatus as to the appearance of the signal, although the wheel-work and operation thereof are the same as already described. Instead of a signal being fixed at the end of a long lever arm, the signal is in the shape of a sector or fan, supported, together with the wheel-work on a pedestal or column, the signal apparatus being placed over the wheel-work. The fan is divided into two colours, one-third red and two-thirds green, or thereabouts, of cloth, or other material, and is furnished at the extremity of the upper border of the frame, with glass to match those colours, and enclosed in a box or screen having a triangular opening through which the fan can be visible in order to exhibit the signal. The three arms as in fig. 1, operate alternately upon a short tail, projecting downwards from the centre of motion, and in the same manner as in fig. 1, and produce the following effect. When the fan is in its resting position, and the wheel machinery is motionless, it is concealed in the upper part of the screen or boxing, but when a train passes, the piece of wood fixed to the engine strikes the curved arm or camb, and the arms are driven in, and the pin released from holding the point of the lever arm, the fan falls by its own weight, and exhibits the red compartment through the triangular opening, and the red glass intercepts the view of a lamp fixed at the top of, and behind the boxing or screen, showing a red light for night; the proper time having elapsed, and the fan being raised, it exhibits green through the opening, and the green glass over the lamp for the remainder of the proper time, and when the whole time has elapsed, it is withdrawn out of sight, and the back of the screen or box, being painted bright white, is seen through the opening.

In some other contrivances that we have seen, for preventing accidents on railways, a self-acting signal apparatus has been acted upon by the wheels of a passing train. This plan must be at once admitted as exceedingly objectionable, the action of *all the wheels* on one side of the train, travelling with great speed, inflicting a succession of rapid blows upon the apparatus, which is not at all the sort of motion that is required, and one which is very likely to injure the machinery employed.

Mr. Curtis has more judiciously attached a projecting piece of wood to the locomotive engine, which alone, and at once, acts upon the signal levers.

We are happy to learn that there is every probability of this apparatus being practically employed on one of our first lines of railways, the directors of which are in treaty with Mr. Curtis for the use of his invention. We wish him all the success which his ingenuity, as well as his humanity so richly merit.

* The periods of time here specified are only mentioned by way of example; they can be adjusted as circumstances require.

## ON THE DUTY OF CORNISH PUMPING ENGINES.

Sir,—Permit me briefly to point out to your correspondent "Mercury," that his ingenious adaptation of the theory of gravitation to the developement of the

*cause* of the difference of duty between the Cornish pumping engines, and the rotative, or the engines in factories, &c., is at once upset by the simple fact, that there are engines (instance the one at Old Ford water-works, and the one lately erected in the Battersea Fields,) which are pumping, *and doing as much duty as in Cornwall.* These engines are not benefiting by the variation of the gravitating power, for they pump not from "deep mines," but from simple reservoirs upon the surface of the earth.

I might have confined myself to the mere question of Mercury's argument, as it affects the duty of the pumping engine; but I think, nevertheless, there are other parts of his communication open to remark, and if no one better able than myself should notice them, I may, at some future time, trouble you again on the subject.

I am, Sir, Yours very respectfully,
JAMES PILBROW.

August 23, 1841.

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### PILBROW'S CONDENSING CYLINDER ENGINE.

Sir,—I thank W. M. for his trouble in investigating my engine. Among the few objections that have been brought against it, the only plausible, though not sound ones, are those advanced by your correspondent.

W. M. thinks, first, that the difference between the vacua in the condenser and cylinder of the common engine, cannot be given in favour of mine, because there cannot be, he says, a more perfect equilibrium in it, than is now found in the common engine; and that if the used steam retards the steam piston more than it presses in favour of the condensing cylinder piston, the difference must be deducted from the power of the stroke.

I had well considered this point, but found the equilibrium in my engine so regular from the first, and so nearly complete, as to be too inconsiderable to complicate the question with the amount of variation. The following explanation will satisfy W. M. that there is a different action between the common engine and mine.

Immediately the eduction valve is opened in the common engine, the steam flows to the condenser, *a large vacuous space*: the condenser, therefore, first receives the used steam *with a vacuum,* which (after being impaired whilst the steam is flowing into it) again becomes equal to what it was at first, but not till the steam has been completely condensed. Take the mean of the condenser vacuum at 26 inches of mercury. The steam cylinder begins its evacuation, not with a vacuum as the condenser, but with a plenum, which is rapidly reduced as the steam is being annihilated, until it ends with a vacuum. Call the mean of this exhaustion 10lbs., or 20 inches of mercury; the difference of 3lbs. per square inch, is that resistance to the piston which is unavoidable in the present engine. I take the lowest it can be reduced to under the best circumstances, and which W. M. assumes will equally affect my engine. But it cannot do so.

The instant the communication is opened between my steam and condensing cylinder, the used steam *does not enter a large vacuous space* as in the condenser of the present engine; on the contrary, it impinges on the solid piston of the condensing cylinder, on the other side of which there is a far more perfect vacuum than is now, or can ever be obtained with an intermediate condenser. It therefore only makes the space, or cold chamber, by the very force it gives out in seeking to enter the vacuum on the other side. The equilibrium is therefore more gradual, more perfect, and continues so, from this cause. It is at the commencement of the stroke, as shown by the indicator, that the present engine loses most of its power, whilst it is at the commencement of the stroke that my engine realises most of its gain.

When the steam has moved the condensing cylinder piston a few inches in seeking to enter the vacuum on the other side, the injection enters, and keeps throwing down the steam till the end of the stroke; an equilibrium almost perfect is thus kept up by the gradually enlarging space that the used steam makes for itself. In the present engine, though the steam has so large a vacuous space to rush into, (a plenum on one side, and a vacuum on the other, to commence with,) yet with *inconceivable rapidity* it expands, and changes its pressure throughout its whole volume, so rapidly indeed, as only to leave a mean difference of 3½, or 4lbs. This shows how suddenly it

does change its condition and its locality under circumstances the most disadvantageous for the plenum side to be so rapidly affected to *so great an extent*. But in my engine, the evacuation begins with a plenum on both sides, (if I may so say for further illustration,) and never finds a vacuous space until it makes it, thus giving time for the steam between the pistons gradually to form, and keep up an equilibrium throughout the stroke, and press equally on each.

It must not be thought that my gain of power ceases, however, when the injection enters. W. M.'s description of what takes place in the condenser of the present engine shows that he is aware, (which very few are,) that the steam cannot be condensed as fast as it enters the condenser. He states that the barometer gauge proves this by indicating by its fall, the presence of steam, air, and gas, and that the mercury does not declare the usual vacuum until the end of the stroke, when the steam has been condensed, arising, as he justly observes, "from the slowness, or rather progressive condensation." The gauge, showing then, that steam is always present during the whole stroke, proves that there must be pressure which the injection water cannot reduce, or the vacuum would continue perfect throughout, as at the end of the stroke. Though there is even a full stream of water flowing into the condenser, and as much admitted as can be, the steam flows with a rapidity so very much greater than condensation can go on, that a portion must always wait to be condensed; *time, therefore, is equally a condition of condensation as a sufficiency of cold medium.* My condensing cylinder piston will consequently be receiving, during the whole stroke, that force of the uncondensed steam or vapour, shown by the barometer gauge to be lost in the present condenser, until the injection water has had the proper time to absorb the caloric, and this will not be done until the end of the stroke as in the present engine; but for the causes before stated, the equilibrium between the pistons of my engine will be nearly perfect. infinitely more so than is now found. The difference indeed between the pressure on my condensing cylinder piston, and the resistance to the steam piston is too minute to be made a subject for calculation. In many branches of science differences exist so minute as to be scarcely conceivable. The firing of batteries by galvanic action may be mentioned; the time, even at great distances cannot be determined, though we know there *is* a difference between the communication and discharge.

Respecting the larger eduction valves, which W. M. thinks my engine may require, I beg to show, that though I shall use them as large as the present, I could advantageously work my engine with valves so small, that if applied to the present engine they would take away nearly half its power. It is the object now to use valves of the utmost possible area, that the used steam may fly out of the way immediately the valve is opened, and be annihilated. I require them only to be as large as to permit the steam to be condensed progressively during the stroke, and as quickly as the pistons move. I do but require an equilibrium *gradually* going on for my engine, whilst, with the present, an equilibrium is sought for *on the instant*. But this can never be obtained, as the piston of rotative engines must always commence to move against a plenum: enlarge the valves how you please, the full power inherent in the steam on the other side can never be wholly available, owing to the resistance, and the want of another piston to give out its reaction. Accurate inquiry, and observation have been made of the action of *the five Cornish engines that do most duty*, and the very liberal answers of the engineers of those five machines, satisfy me that one great cause (there are others well considered, in the pamphlet on my engine*) of their superior duty, is the commencement of the stroke of the piston in a perfectly exhausted cylinder. Mr. West, the well known engineer of Austin's celebrated engine at Fowey Consols, in answer to a communication whilst I was pursuing the theory of their greater duty, and tracing each effect to its right cause, says, "The piston *always* rests a short time at the top of the cylinder, and the exhaustion valve is opened *one or two seconds* before the steam valve." Steam flows with such rapidity to a large vacuous space, that this gives sufficient time for a complete exhaustion; but as W. M. admits there is a difference in rotative engines, of 3½. or 4lbs. per square inch, between

* Published by Weale, Architectural Library, High Holborn.

the cylinder and condenser vacua, I need not pursue this point further. In my engine the power of the steam is given out to its last particle.

I do not clearly understand W. M.'s observation about the steam-piston pursuing the steam, whilst the condensing cylinder piston flies from the vacuum. As there must always be a more perfect vacuum on that side of the last named piston, where it is already formed, than on the side where the steam is being condensed, and the vacuum is *being* formed, the difference of pressure will always propel the piston by seeking the more perfect vacuum. W. M. objecting to the double action of the condensing cylinder piston, says, "there is an important circumstance that appears to be overlooked," and in explanation would make it appear that it is necessary always to have present three condensements to prevent any "crash," that this would entail on the engine a considerable loss, and it must therefore be considered as greatly inferior to Watt's plan.

I should not have expected this objection, and the subsequent observations in support thereof, from the ingenuity of the former part of W. M.'s paper. The space between the piston, and upper and lower parts of the condensing cylinder will be proportioned to the size of the engines, for the largest engines made on my plan, one inch will be ample. The water between is one cushion, though not an elastic one; but above it is another, an elastic cushion of a very complete kind, composed of the liberated air and gas, which will be compressed until they overcome the resistance of the atmosphere, and open the valve for their escape. As these are always above the water remaining on the top of the condensing cylinder piston, and above the water resting at the bottom of the condensing cylinder, they must be always expelled before any water can follow. An inch of water will ever remain unexpelled; say the second condensement adds another inch of water; at each reversal of the piston all air and gas are discharged first, preventing any "crash" by their increments of compression; then follows the inch of water, leaving the one inch remaining, but entirely freed of all air and gas. The discharge valve at the side, at the bottom of the condensing cylinder, is properly arranged to permit the air and gas above the water that rests there to be expelled first, on the down stroke of the piston. But if it were necessary, as stated by W. M., to have three condensements constantly to remain, to prevent any "crash," or ten condensements, still there would be no accumulation of air and gases to "entail on the engine a considerable loss," or any loss at all. Water is not elastic, like air, to expand in a vacuous space, and to impair the vacuum. Whatever the quantity, the temperature is the same, and will give the resistance due to its temperature alone, being free from all air and gas, these, being specifically lighter than the water, rise to the top and are discharged, as before observed, before any portion of the water can follow. But, with an intermediate condenser, all air and gas cannot be withdrawn at each stroke of the air-pump; half, at least must remain in the separate condenser, which will expand, and make the extreme vacuum less, by about 1lb., than is due to the temperature of the water alone. By reference to the numerous tables of the amount of the elastic force of vapour at different temperatures, this fact will be confirmed.

No "enormous additional burden" thrown on my engine, not an ounce, whether the condensement is thrown out by a large area of piston, and a short period of discharge, (as in my engine,) or by a small area of piston, and a long period of discharge, (as in the present engine,) the total effect of the pressure of the atmosphere must be the same, the quantities being, as they will be, equal; nor can any greater "crash," or strain take place, with my engine, than with the present, the conditions under which the condensement is discharged, and the atmosphere met, being the same.

The beauties of the crank's action, and its admirable adaptation to the wants of the engine, must be familiar to W. M. I beg him to observe the admirable ease and conformation of its action in favour of my engine, to prevent the possibility of "strain" or "crash." If, whilst the crank were at quarter stroke, the piston had to force out the condensement, it would be travelling at such speed that neither the quantity of air, nor the water would be sufficient to prevent a jar. But let him calculate the speed of the piston when within an inch of the

termination of its stroke, with a crank of 3 feet 6 inches throw, moving with its uniform rate, that would agree with the piston's usual rate of 220 feet per minute. He will then admit how softly the air and water are expelled by the *gentle* pressure of the piston.

As to friction, there is no more in my engine than the present, except the difference between the size of the piston of my condensing cylinder, and that of the usual air-pump. This I have allowed for by the most popular rules. My engine is more simple than the present, being composed of two compartments instead of three; two cylinders and pistons of equal size, instead of two cylinders and pistons of different size, and a separate condenser. I have no valves in my second piston, as in the present air-pump, but I have two valves to regulate the injection, which saves the engineer all trouble. In a crowded river, or where the speed of the engine varies at sea, this perhaps may be considered an advantage. The condensing cylinder engine is not heavier, it occupies less space, and is less expensive to make; three different moulds are required for the present engine, but only one for mine.

I would observe, in conclusion, that nothing is "assumed" in the pamphlet, (one of which I have left at 166, Fleet-street, for the acceptance of W. M.) The facts of Mr. Watt's experiments are taken from works of approved authority, and the pages referred to. If the practice of Great Britain's most eminent engineer is wrong, or the facts incorrectly recorded, I can take no blame to myself for using both as my guide. The diagrams of the present day are better, or rather, squarer, than those of Mr. Watt's, but as these are obtained by some loss of the effect of steam-pressure, by opening the eduction valve earlier, and as the sum of the whole effective force is but very little better, and obtained by a condensement below 100°, and as rotative engines *burn now as much fuel as Mr. Watt's* (allowance being made for using steam expansively,) and as they do not work beyond the actual working power of Mr. Watt's engines, I conclude there still remains as much loss between the condenser and cylinder vacua of engines of the present day, as Mr. Watt found by the indicator in his, namely, 3¼lbs. upon the average. However "startling," therefore, may seem the statements in the pamphlet, science will not be frightened at them, but calmly investigate, and dispassionately decide.

If W. M. be not thoroughly satisfied with this reply, I beg he will set it down to the greater difficulty I find in writing, than in verbal communication, and not to the defects of the engine, and that he will in such case give me another opportunity of further explanation.

I am, sir,

respectfully yours,

James Pilbrow.

Tottenham Green, Aug. 21, 1841.

P.S. I see on the cover of your last Number, a paper on my engine announced by Lowemnaphretts; should it be opposed to me, may I beg your readers to compare it with the foregoing, as the comparison may, perhaps, render it unnecessary for me again to occupy your columns.

## ON THE ADMISSION OF AIR TO FURNACES.—BY C. W. WILLIAMS, ESQ.

(In continuation of a Lecture reported in *Mech. Mag.* No. 940, p. 118.)

There is a prevailing misapprehension among practical engineers respecting the conditions under which atmospheric air should be introduced to a furnace, and hence a series of errors has arisen, as to the effect of such introduction, and the circumstances which give it a useful or injurious tendency. This misapprehension, alone attributable to our neglect of the chemistry of combustion, has led us from one failure to another, until the public are fairly tired of "smoke burning" expedients. Every new scheme is regarded but as a new piece of quackery, and the consequence is a prevailing indisposition towards any farther efforts, lest they should only lead to further expense and disappointment.

How, then, has this unsatisfactory state of things arisen? How is it that we have become almost reconciled to the idea that the nuisance of smoke is irremediable, and a necessary accompaniment of the use of coal and the steam engine? Here is the cause; practical men, who have had the charge of constructing our furnaces, have been guided by mechanical, rather than chemical laws, considerations, and cal-

culations, and the public have been the sufferers.

But if it be true that "smoke burning" is either quackery or ignorance, gas burning *without smoke* is assuredly not so, as daily experience abundantly proves. Why then do we succeed in the burning of gas in the lamps, yet fail in the furnace? Here is a distinction so palpable, that it is strange it should so long be overlooked. We do not attempt to burn smoke in the former, why then do so in the latter? But we endeavour to prevent its existence in the lamp, why then not do so in the furnace? Flame, in the furnace, and in the lamp, is the same thing, the material from which it is obtained is the same in both cases, the gases generated are the same, the constituents from which heat and light are produced are the same, the processes of nature, chemical and electrical, which constitute combustion, are equally active in both.

In what, then, consists the difference? A little inquiry, if directed in the right channel, will satisfy us that it arises solely from the difference in the *manner*, and *principle*, on which atmospheric air is introduced to the combustible gases, in the two cases, involving the several conditions of time, place, temperature, quantity, and diffusion; yet to none of these have practical men directed their inquiries, while they repudiate the interference of scientific men, who would give their ingenuity the proper direction. As these conditions have been considered in my treatise on combustion,* I will here merely offer some general observations on their practical application in the furnace.

The first point to be noticed, is the prevailing inattention to the admission of air for the uses of the furnace, beyond the fact that it is allowed to enter *ad libitum* by the ash-pit and bars, but by no other channel. This is done under the expectation that nature will work out her own purposes, and effect all that is necessary, by her own means, and in her own way. Had this mode of reasoning prevailed, as regards gas-burning in the *lamps*, we should, to this day, have been ignorant of those modes by which the most brilliant lights in our rooms, and the most intense heats in our laboratories, are now obtained, seeing that they are exclusively referable to improved methods for bringing atmospheric air, and the combustible gases, into contact.

With the view, then, of obtaining equal success in the furnace, as in the lamp, we should ascertain in what consists the distinction, as to practice, principle, and effect, in these two cases. Inquiry thus directed, will soon lead to satisfactory results, and show the error of directing our attention to the mere mechanical surfaces and proportions of boilers, furnaces, and flues, as Tredgold, Armstrong, and others have done, to the neglect, if not in defiance, of the exigencies of nature, in working out the several complex processes of combustion.

Another point requiring special attention, but which, in ordinary practice is overlooked, is, that in the use of coal, there are two distinct things, or bodies to be acted on, and which require distinct arrangements as regards the admission and use of atmospheric air, namely, the gaseous matter generated in the furnace, and the carbonaceous, or coky matter, after such gases have been separated from it; the one remaining solid on the bars, the other, carried into the flues by the draught, as fast as generated.

The first inference from these facts is, that as these two bodies present such distinctive characteristics, two distinct supplies of air must necessarily be required, and so to be managed, that neither shall have access to, or interfere with the supply intended for the other. These facts seem to have presented themselves to the minds of many ingenious and observing men: their failure, however, in effecting perfect combustion, may be traced to the circumstance of their not perceiving that something more was required than the mere introduction and separation of the two supplies of air, and that attention to the *manner* in which they were introduced was as essential to success as providing the *matter*.

In a letter inserted in the *Mechanics' Magazine* (vol. xxxiv, p. 314.,) there is a striking instance of the want of discrimination in this respect, and of inattention to the chemical conditions

* Combustion of Coal Chemically and Practically considered, with coloured plates.—Simpkin and Co.

which these varying modes involve, and without which the union between the combustible matter and the air cannot take place. The result of this indiscriminate consideration generally is, that all are set down as producing the same effect; the faults of one are considered as common to all, and the whole characterized as mere re-inventions, in other forms, of what has been before the public during the last twenty years; the writer in that letter observes:—

"With respect to plans for burning the smoke, I have to remark that the chief objection to them is, that they nearly all require the admission of a large quantity of cold undecomposed atmospheric air, direct to the body of the furnace. Now the evils arising from the admission of cold air to the furnace-chamber of a steam engine boiler are numerous; it not only checks the generation of steam by impinging against, and cooling, the heating surface of the boiler, but it also checks or diminishes the velocity of the draught of air passing through the fire grate, by lowering the temperature of the column of air in the chimney, on which the draught itself depends, thus lessening the intensity of the heat in the fire-place, and thereby, in effect, diminishing the evaporative power of the boiler."

Now the whole of this enumeration of ingenious results may belong to certain injudicious modes of introducing air, as when the fire-door is opened, but to connect them indiscriminately with the admission of cold air, is to overlook the distinctions between a right and a wrong mode of admission.

But to bring these alleged evils from the admission of cold air distinctly before us, they are, 1st, that it "checks the generation of steam;" 2d, it "cools the heating surface of the boiler;" 3d, it diminishes the draught through the fire-grate; 4th, it "lowers the temperature of the air in the chimney;" 5, it "lessens the intensity of the heat in the fire-place;" and 6th, it "diminishes the evaporative power of the boiler." If the plan and principle of admitting air, which I propose be attended with these results, it would be as little necessary to take any trouble in writing it down, as it would be in puffing it up, for it must soon work out its own condemnation; and of this very mode, the writer adds, "In no one plan that I have ever met with is the *almost* insurmountable nature of the difficulty more conspicuously illustrated, both in theory and practice."

Now the saving term, "almost," relieves the writer from the charge of intentionally alleging as facts, what are so susceptible of disproof, and therefore in fairness I must add, that he could not have seen a large body of air admitted to the gases of a furnace, on the mode I have successfully adopted, or he could not have resisted the conviction which his own senses must have forced upon him in witnessing the difficulty absolutely overcome, and with this important addition, that it is done on strict chemical principles, and in accordance with the opinions of the first chemical authorities of the age. In truth, there is neither difficulty nor mystery in the matter, if we only examine the chemical conditions of combustion, and as we daily witness them in an ordinary Argand gas burner.

The following letter will sufficiently disprove the most important of the above allegations:—

Liverpool and Harrington Water-works Company, July 22, 1841.

Dear Sir,—When I had the pleasure of attending your lectures at the Literary Institution, you convinced me that your invention for the more perfect combustion of coal, and prevention of smoke was founded on correct principles; but I must confess, I had no idea you would be enabled to carry them out so very successfully as you have done, at the company's station in Soho-street. I have lately had many inquiries on the subject, and have invariably invited the parties to visit the works, and judge for themselves; and I have pleasure in stating, that one and all have expressed themselves not only much pleased, but astonished, at seeing the fire loaded with coal, and instead of a dense smoke issuing from the chimney, (as is usually the case,) finding that which is generally made into smoke a beautiful flame, giving out an intense heat, and thus saving fuel. Since the adoption of your plan, although we use less coal, we have a large increase in the quantity of steam.

I am, dear Sir, your obedient servant,

THOMAS THOMPSON, Manager.

To C. W. Williams, Esq.

Fearing to occupy too much of your space, with your permisson I will conclude these observations at another opportunity.

I am, Sir, yours, &c.

C. W. WILLIAMS.

Liverpool, August 20, 1841.

SIMPLE METHOD OF TRANSFERRING DAGUERREOTYPE IMPRESSIONS.

Sir,—Allow me, through the medium of your pages, to publish a method I have discovered of transferring the impression of a daguerreotype plate to paper. I send you an imperfect specimen, by which you will see that the impression is distinct, though pale, but so perfect, that it will, like its original, bear a strong magnifying power. The process is very simple, and merely consists in pressing a piece of black or dark paper covered with some glutinous wash, upon the daguerreotype plate; the deposit of mercury forming the lights, comes off with the paper when dry. The impression the *reverse* of the daguerreotype is, of course, a *correct* picture of the object.

This method, though yet imperfect, and producing a picture inferior to the original, may be useful for preserving views which are not worth keeping, at the cost of a silvered plate, and they may be inserted in a book, not being liable to obliteration by the touch, as the original.

Your obedient servant,
GEORGE EDWARDS.

Lowestoff Harbour, Aug. 26, 1846.

(The specimen sent us by Mr. Edwards, and which he calls *imperfect*, shows at least that the process is perfect, as well as simple; the only objection that we perceive, arises from the gloss of the paper, which might, perhaps, be removed by some deadening wash.—ED. M. M.)

ELECTRICITY — THUNDER STORM AT LIVERPOOL — CONDUCTORS, &c. BY HENRY DIRCKS, ESQ.

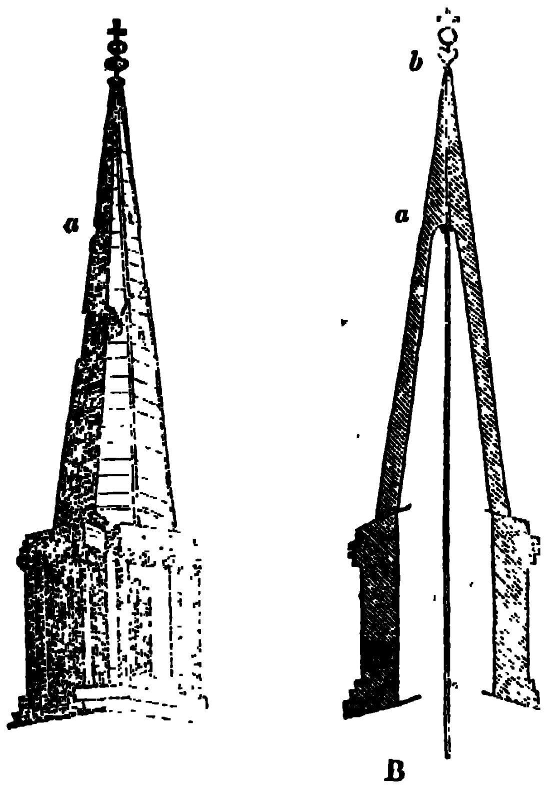
Sir,—Whatever is not of common or self-evident benefit to the community at large, is too apt to be viewed with indifference, and to be allowed to fall into neglect. Often, the very individuals who are loudest to acknowledge how wonderful nature is in all her works, see too indistinctly the actual value of minute investigations into natural phenomena. The electrician, till lately, was considered as versed merely in a kind of philosophical sport, a species of natural magic, most entertaining, though otherwise valueless. The subject of electrical action, taking the term in its fullest sense, is one which, in the hands of modern experimentalists, has grown to vast importance, opening to view a wide field of curious instruction, and singularly beautiful phenomena for future adaptation to useful ends. Its range in chemistry, mechanics, and the fine arts is already pretty well understood, and as a benefit for the preservation of life and property it has long been urged on public attention, though, as we shall presently perceive, without producing the desired effect to the extent that might be hoped for in these days of refinement and intelligence. Desirable and acknowledged improvements are tardily adopted, of which innumerable instances might easily be adduced, were it requisite, but scarcely any perhaps, more glaring, because so inexpensive and beneficial, need be named, than the scarcity of lightning conductors to our public buildings, and in particular, to sacred edifices, with their lofty spires, most invitingly situated to attract the electric fluid from the overhanging thunder cloud. It is a merciful piece of providence that we are not visited by more continuous and violent thunder storms than those which usually occur. Few, indeed, of our elevated buildings could escape, being, as they are, unprovided for such an emergency, so much so, indeed, that it might rather be a studied effort to make them objects for utter destruction, so ill-adjusted and contrived are most of our church spires.

Let us take a notable example of this insufficient protection, illustrated in the late fearful destruction of two church spires in Liverpool.

On Tuesday, the 24th of August, about two o'clock in the morning, this town was visited by a dreadful thunder storm, which at that early hour, while all else was hushed, raged with awful impetuosity. Two distinct peals of thunder were remarked, and two evidences of the effects of the storm stand as warning monuments at either end of the town to mark the destructive power of that element which can only pass harmless by complete and perfect good conductors. These churches are St. Martin's in the Fields, at the North end, and St. Michael's at the South end of the town; the former, not surrounded by many buildings, but

in the immediate neighbourhood of one of the highest chimneys: and the latter, in the very heart of a populous district, and which, being more shattered than the other, (while both have suffered sufficiently to warrant the taking down of a large portion,) the description of this will, in the main points, suffice for both.

The spire of St. Michael's has always been justly considered one of the most beautiful of these structures in the town; its summit is octangular, terminating in a capital, from which, to the ground, it measures 201 feet. The church altogether has cost upwards of £45,267. Its spire is now, as may be judged from the annexed sketch A, but




N. W. view.

"a thunder-splintered pinnacle." The Journalists, in noticing this sad disaster, observe, that "the lightning appears to have struck the spire *near* the top." As far as *appearances* go, this can readily be understood; but the most rational conclusion, is, that the cross and ball which crown its top received the first shock, transmitting it by the iron rod, *a, b,* in the sectional view; B, passing through the masonry forming the apex of the spire, and which, being uninjured, will appear not to have encountered the fluid which elsewhere has rived the solid stone. Supposing the termination of the iron stay at *a b*, the only next direct course would be to the iron clamps which bind the masonry throughout the remaining length of the octagonal portion of the spire; these clamps were the only metallic conductors it could meet with, and its attraction for a metallic course appears to have been so prodigious, that it has ripped its way through every impediment, in its usual tortuous zig-zag direction, down to the base, where it may have taken an internal course, passing through, and splitting the tower, doing infinite damage. Here, still making towards the best conductors, it seems to have turned towards the east side, where it would find a ready passage among the clock-work there, then, in making its egress lower down, it has forced out a large stone beneath the clock, on the pedestal, probably attracted by some leading. The works thus deranged, and the bell displaced either immediately by the electric fluid, or otherwise by the stone-work falling, the clock has stopped at 20 minutes past two, the exact time, no doubt, of the accident.

The occurrence here detailed is simply dependent, in all its particulars, on the chain of good and imperfect conductors presented by the object of destruction, possibly rendered a still easier prey by previous dampness of the free-stone of which it is built; the effect of this being to facilitate the progress of the electric fluid over a greater space of bad conducting surface. But who can estimate the violent disruptive power of acres of electrified clouds, discharging their whole artillery on one point, with ungovernable impetuosity? The *tonitru* and *fulgur*, the noise and lightning, on this occasion, have been described as sublimely terrific, the lightning vividly illuminating the firmament, and the reverberating peals of thunder, attended, as it were, with the shock of an earthquake: it is next to a miracle that the spire has so far withstood the blast as not to have fallen. The whole stones and fragments blown out by the successive explosions in the passage of the electric fluid, have done no mischief of consequence; some have been projected to a distance in the churchyard, where they lie embedded in the grass-plot, others have

fallen on the roof, breaking only the slates; others, the flagging beneath.

The fluid, in its passage, has left a bluish discolouration, which distinctly marks its course. The thunder was immediately followed by deluging torrents of rain pouring forth from the clouds in a complete flood, inundating all the lower parts of the town.

After accidents of such consequence, bearing a distinct character, and no ways dubious or doubtful, but in strict accordance with long acknowledged theory, it becomes a matter worthy of serious inquiry, whether the protection afforded by lightning conductors is not, in all cases, but especially for church spires, particularly advisable. What would have been the expense of a continuous metal rod, as *a*, B, in the sectional sketch of 201 feet, in comparison of the time, cost, trouble, and annoyance, of taking down, and rebuilding, this once noble spire, now shattered, and in danger of toppling over on to the body of the church? A great public thoroughfare is obliged to be blockaded in consequence, and the greatest fears are entertained lest ever so moderate a gale should blow.

The utmost pains have been taken to furnish our navy with lightning conductors. Marine lightning rods are of acknowledged utility, there being undoubtedly a greater chance in a migratory course, than in a stationary situation, of encountering the dreaded enemy. But still, as long as their utility remains undisputed, and as long as the mode of their construction is both cheap and simple, it is surely highly reprehensible that so few lofty edifices are supplied with these safe-guards. It is a vulgar error that an iron rod attracts a thunder cloud, under the idea that the cloud so attracted might otherwise have passed away. It certainly does attract the electric fluid from the cloud when present; but its presence, it may fairly be presumed, is very rarely dependant on that of the thunder rod. The thunder cloud makes its appearance impelled by some unknown cause to a particular quarter, and will strike the summit of the nearest object, high or low, that is in its immediate vicinity—the tree, the passenger, the cattle or the cottage. I have seen one of a range of new small houses struck by lightning, while only a very few yards from a church with a moderately-high steeple, and in the neighbourhood of trees and a number of buildings, so that it is erroneous to suppose that the loftiest objects are the only ones in danger, though it is unquestionably more common. A thunder cloud passing over a large town, bristled over with conductors from castle, church, mansion and cottage, would doubtless lose somewhat of its intensity, but to imagine it would move east, west, north or south, under the spell of any single conductor, is supposing an attractive influence in the protruding point of a metal rod elevated some 50 or 100 feet above the earth's surface, which it may very reasonably be suspected does not actually exist, more particularly in this climate, where the frequency and violence of atmospheric electricity is rarely experienced. We are still, however, sufficiently alive to the devastating effects of the electric fluid in its most accumulated and active state to feel satisfied of the necessity of adopting an ever-ready channel for its safe transmission, so that when our variable atmosphere is favourable for the mysterious exhibition of the thunder storm with all its attendant horrors, our protected buildings may pass unscathed by the threatening thunder bolt.

Manchester, August, 1841.

## MECHANICAL DRAWING.

We welcomed, in a recent Number, the appearance of Part I. of a Hand-book, by Mr. Wilme,* which appeared to have for its object to supply that general desideratum—a good lesson-book for tyros in mechanical drawing; but, on looking through the specimen before us, we can hardly say it comes up to the idea we had formed of it. It seems intended to be simply a collection of styles of lettering and ornamenting plans, maps, &c.: indeed, the author avows that his chief, if not sole object is, to supply engineers and surveyors with a hand-book to which they can readily refer for whatever may be required in constructing their plans and drawings, *without the tedium of designing.* Now, certainly, it is not this which is so much wanted, as a book which would teach persons to *design for themselves.* Perhaps Mr. Wilme may yet enlarge the plan of his work, so as to accomplish both purposes. So far as it goes it is deserving, however, of every commendation.

* A Hand-book for Plain and Ornamental Mapping, and Engineering Drawing, &c. By Benjamin P. Wilme, C. E. Five Plates; 4to.; London; Weale.

The styles selected exhibit a great deal of taste, and, in several instances, no small degree of originality.

## ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

*** *Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for that purpose.*

PHILLIP WILLIAM PHILLIPS, OF CLARENCE-PLACE, BRISTOL, GENTLEMAN, AND WILLIAM BISHOP PEEK, OF BROAD-STREET, BRISTOL, WINE MERCHANT, *for improvements in four-wheeled carriages.* Enrolment Office, August 15, 1841.

These improvements apply to such four-wheeled carriages as have two bodies capable of independent motion. The two bodies are connected together by the following locking apparatus:—On the under part of the hind body there is a circular hoop or plate; a circular strap embraces and turns freely upon this hoop, being kept in position by two rings fixed on the upper end, and under surfaces of the hoop. One end of a short pole, or bar, is fastened to the strap, while its other end is attached beneath the fore body; so that when the fore-body turns in passing round a curve on the road, it describes a portion of a circle, the centre of which corresponds with the middle of the hoop.

The locking motion does not range through the circle, but is limited by a stop on the strap coming in contact with two stops on the rings. Two other modifications of locking apparatus are also described, but they do not differ greatly from the foregoing.

WILLIAM EDWARD NEWTON, OF CHANCERY-LANE, MECHANICAL DRAFTSMAN, *for improvements in obtaining a concentrated extract of hops, which the inventor denominates "Humuline."* (A communication.) Petty Bag Office, August 15, 1841.

The hops are dried till brittle in an oven heated to 86° Fahrenheit, and are then passed through a coarse sieve; this powder is placed in a close cylinder and covered with alcohol to a depth of $1\frac{1}{2}$ inches and submitted to pressure for twenty-four hours. The alcoholic tincture is then drawn off into a tub, and the powdered hops washed repeatedly in water till no further extract remains in them.

The alcoholic tincture, and the essential oil which is combined with it, is placed in a water-bath, and the alcohol driven off, which leaves the essential oil remaining behind in the form of a brownish-yellow resin covered with a yellowish watery extract. This extract is added to the aqueous solution, and evaporated by an open fire to the consistence of syrup; it is then removed to the water-bath and evaporated to a nearly solid extract. This extract is added to the resinous matter of the alcoholic tincture in a warm state, and the compound thus produced is the "Humuline," 2 lbs. of which, are equal in use to 6 lbs. of hops.

Another mode is to place hops either powdered or whole in a closed vessel, and expose them to the action of steam, when a liquid extract is obtained, which, by evaporation, may be converted into "Humuline."

The claim is to the methods herein described, of making or producing a concentrated extract of hops.

JAMES RANSOME AND CHARLES MAY, OF IPSWICH, SUFFOLK, MACHINE-MAKERS, *for improvements in the manufacture of railway chairs, railway and other pins or bolts, and in wood fastenings and tree-nails.* Enrolment Office, August 15, 1841.

These improvements in the manufacture of railway chairs, consist in the employment of metal side plates in the sand mould in which the chair is cast; and also in using metal cores for the cavity in the chair which receives the rail.

The second improvement, relating to the manufacture of wooden pins or bolts, consists in forcing them into moulds, (which are cylindrical tubes slightly tapered towards the mouth,) and submitting them while under compression, to the action of heat, until the natural elasticity of the wood is sufficiently overcome. The pins will then retain the form thus given them until driven into damp sleepers, when the moisture will cause them to swell, and they will become firmly fixed therein. The wood fastenings and tree-nails are treated in a similar manner.

The claim is—1. To the mode of casting railway chairs by means of metal side surfaces in sand moulds, with metal or other cores as described.

2. To the mode of casting railway chairs, by applying metal cores as described.

3. To the mode of manufacturing railway and other pins or bolts, and wood fastenings and tree-nails, by forcing them into moulds so formed as to retain them under compression till the elasticity of the wood is sufficiently overcome.

4. To the mode of manufacturing railway and other pins or bolts, and wood fastenings and tree-nails, by subjecting them to heat, when under compression in moulds as described.

JAMES WHITELAW AND GEORGE WHITELAW, OF GLASGOW, ENGINEERS, *for a new mode of propelling vessels through the water, with certain improvements in the steam-engine when used in connection therewith, part of which improvements are applicable to other purposes.* Enrolment Office, August 15, 1841.

This new mode of propelling, consists in forcing air through openings in the bottom of the vessel, which passes in divided currents along channels or spaces inclining upward from the bottom of the vessel toward the stern, where it escapes at the surface of the water. The propelling power is derived from the buoyancy of the air—the force which it gives out, as it expands in its passage to the surface of the water—and, the force from reaction which is communicated to the vessel as the air escapes. In order to back the vessel, the air is forced out through pipes directed towards the bow of the vessel.

The improved steam-engine consists of a horizontal cylinder through the centre of which a main shaft passes, carrying two vibrating vertical fans, which together fill the diameter of the cylinders, and greatly resemble a Bramah's pump. On one side of this cylinder, is another of equal size and similarly constructed, which forms the air-pump for propelling the vessel, while on the opposite side is the air-pump of the steam-engine. The shafts are all connected so as to move together. On admitting steam to the engine, the fans make a vibratory movement, each motion of the air-pump forcing a portion of air into the channel before mentioned, along which it passes in broken currents, which the patentees consider more advantageous than a continuous current of air.

WILLIAM SCAMP, OF CHARLTON-TERRACE, WOOLWICH, SURVEYOR, *for an application of machinery to steam vessels, for the removal of sand, mud, soil, and other matters from the sea, rivers, docks, harbours, and other bodies of water.* Enrolment Office, August 16, 1841.

An agitator, consisting of a barrel studded with long spikes, is supported by side rods, the ends of which are jointed on a shaft geared to the engine-shaft, and extending across the vessel, so as to admit of the agitator's rising and falling according to the inequalities of the ground. Two endless chains proceeding from the latter shaft work round pulleys on the axis of the agitator, and give it a rapid motion whereby the sand, mud, &c. become mixed with the water, and are carried away by it. When out of use the agitator is raised up by a chain and windlass.

The claim is to the mode of applying apparatus or machinery, to the propelling machinery of steam-vessels, for the purpose of producing a rotary motion in the agitator, so as to stir up the mud or other matters, and thus cause them to mix with the surrounding water.

WILLIAM SAMUEL HENSON, FORMERLY OF ALLEN-STREET, LAMBETH, BUT NOW OF NEW CITY CHAMBERS, LONDON, ENGINEER, *for certain improvements in steam engines.* Petty Bag Office, August 16, 1841.

In this high pressure condensing steam-engine, the steam chambers are each furnished with an escape-valve closed by a spring; these valves are kept shut by rods and levers worked by cams on the main shaft, the pressure of which is withdrawn when the valves are to be permitted to open. Thus, supposing the piston to be near the completion of its downward stroke, the pressure is removed from the upper escape-valve, when the steam forces it open, and rushes out until the steam within the cylinder is reduced to a slight excess above atmospheric pressure, when the spring closes the valve: the upper eduction-valve is now opened, and the remainder of the steam passes into the condenser. The piston then makes its upward stroke, and the opposite set of valves act in a similar manner.

The engine is furnished with two condensers, each having a valve at the top opened by rods worked by the engine; and also a valve at bottom kept shut by a spring, but opening into a casing, which communicates by a valve opening outwards with a cold water tank. Each condenser is provided with a jet, and is enclosed in a separate cistern, having a side valve for the admission of cold water, and two valves in its base through which the water is conveyed into the casing, and thence back into the cold-water tank. At the termination of a stroke, the steam is admitted through the eduction-pipe into a chamber above the condensers; the upper valve of one of the condensers being opened, the steam enters and forces out the condensation water of the previous stroke through the lower valve, escaping with it, until the steam in the chamber is in equilibrium with the atmosphere, when the spring closes the lower valve.

The upper valve of the other condenser is now opened, and the remainder of the steam admitted and condensed by the injection of cold water, producing a partial vacuum within the condenser. During these operations, the cistern of the latter condenser is filled with water, while the former is empty. Towards the termination of the succeeding stroke, the water is allowed to run off from the latter cistern, by opening its lower valve, and the jet is turned off: at the same time cold water is admitted into the cistern of the first condenser and its jet turned on. The same operations as before then take place, the order of the condensers only being reversed.

In order to guard against explosion, the patentee places a governor on the top of the steam boiler, which is connected with the safety-valve by a long lever, in such a manner, that while the engine is at work, and the governor in motion, the safety-valve is closed, but as soon as the engine stops, the governor opens the safety-valve and lets off the steam.

The claim is—1. To the application to

the cylinder of a steam-engine using a condenser, or to the passages between the cylinder of a steam-engine and its condenser, of an apparatus of the nature of that described, so as to permit the escape from the cylinder, or from the steam passages between the cylinder and the condenser, during a very short interval of time near the termination of each stroke, of so much steam as will leave the remainder of the steam within the cylinder, but little above atmospheric pressure, and condensing that remainder by the means ordinarily used in condensing engines.

2. To the clearing the condensers of steam-engines, in which high-pressure steam is used, by the application to that purpose of part of the force by which steam, used in such engines exceeds the pressure of the atmosphere, when combined with condensers, at intervals immersed in water, as described.

3. To the application of a governor to the safety-valve of steam-engine boilers, by which the safety-valve is raised when the engine is at rest.

John Collard Drake, of Elm-tree-road, St. John's Wood, Land Surveyor, *for improvements in scales used in drawing and laying down plans.* Enrolment Office, August 18, 1841. The paper which is to be drawn upon, is to be cemented on linen or cotton cloth with a solution of India-rubber. From this paper a strip is then to be cut, and divided according to the intended work, like the scales in ordinary use.

In order to use this scale, it is affixed to a straight-edge or holder, and the offset scale is provided at one end with a small metal frame which works against the edge of the holder.

The claim is to the modes herein described of constructing paper scales, with apparatus for applying the same in drawing and laying down plans; whereby the scales, and the plans laid down from the same, will be liable to the same effects of expansion and contraction.

Moses Poole, of Lincoln's-inn, Gentleman, *for improvements in tanning and dressing, or currying skins,* (a communication.) Enrolment Office, August 22, 1841.

The fresh skins, in the green state, are soaked in water 48 hours, after which, they are placed in a kind of fulling mill, consisting of a frame, in which there are a number of rammers, and beneath them is a moveable case, in which the skins are put, and subjected to the action of the rammers for an hour. The skins are then taken to another vessel, containing a series of revolving beaters, the skins and the liquor in which they are immersed being placed at the bottom of it.

After the skins have been beaten for some time, the temperature is raised to 40° or 50° Fahr., by the admission of steam; they are then removed to another vessel, and subjected to a running stream of luke-warm water for 24 hours. In order to act upon the skins more expeditiously, lime-water is used instead of the lime-milk usually employed.

The skins are next passed through a machine consisting of a pair of rollers, one of which carries a cutter; this cutter acts upon the hairy side of the skin, removing all the hair, and equalising the thickness of the skin. Having been thus prepared for the tanning process, the skins are again placed in the fulling apparatus, and worked in luke-warm water, and then removed to the second apparatus, and saturated for several hours with weak tanning liquor. They are then piled up for a couple of hours, after which they are placed in stronger liquor, and are removed once a-day, for the first three days, after which, they are left till sufficiently saturated, being fulled once in every 48 hours.

After being tanned, the skins are rubbed over with oil and tallow, and placed in a cylinder, from the inner surface of which, a number of pegs project; the cylinder is made to revolve for about half-an-hour, when the fatty matter will have been absorbed, and the skins may be stretched, dried, and finished, in the usual way.

Thomas William Booker, of Melin Griffiths Works, near Cardiff, Iron Master, *for improvements in the manufacture of iron.*—Enrolment Office, August 21, 1841.

For the purpose of converting cast iron from its crude state, into wrought or malleable iron, an open refinery, or furnace, is connected with a reverberatory, or puddling furnace, by a passage which terminates in its neck. The refining furnace having been sufficiently heated, a charge of about 9 cwt. of cast-iron is thrown in, and melted down in the ordinary way; when the refining process is complete, the whole charge of metal is run off into the puddling furnace, previously heated to a proper degree. The iron is then puddled in the usual manner, and divided into lumps or balls of a convenient size, which are passed to the rolling cylinders, &c. to be finished.

The principal novelty in the process consists in causing the heated metal of the refining furnace to pass directly into a puddling furnace without being permitted to become cold.

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BLAXLAND'S PATENT SUB-MARINE PROPELLER.

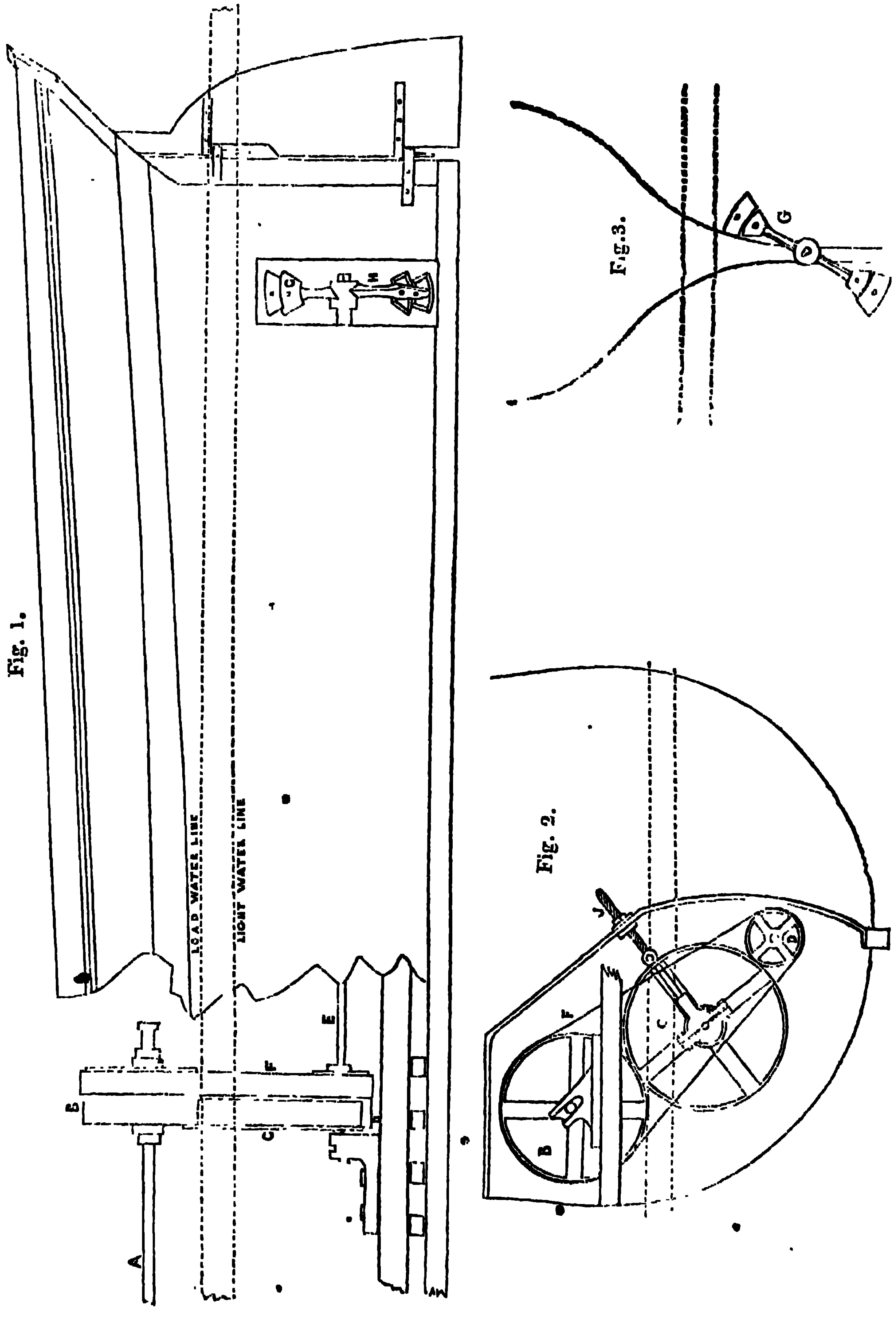


Fig. 1.

Fig. 2.

Fig. 3.

## BLAXLAND'S PATENT SUB-MARINE PROPELLER.

The disadvantages attending the use of the paddle-wheel are now so generally acknowledged, that a substitute, wholly free from its defects, is become an acknowledged desideratum. The numerous attempts which of late have been made to supersede it, plainly evidence the prevailing sense of its imperfections.

These attempts have long tended, and now have become almost entirely directed, to the adaptation of some mechanical power to the stern of the vessel, which shall act below the surface of the water.

It is not intended here to enter into a comparison of the different inventions which have been patented for this purpose. Suffice it to say, that experiment has fully established the general fact of the practicability of propelling from the stem; and that the impediments to the complete success of former patents are stated to have been overcome in the "Sub-marine Propeller," which is now submitted to the notice of the public.

Of these impediments one more particularly deserving mention, is the difficulty of giving the requisite velocity to the Propeller Shaft, without the intervention of spur wheels and pinions, so intolerable from the *noise* and tremulous motion they occasion, and otherwise objectionable from their rapid wear, liability to derangement, and great waste of power.

This difficulty is stated at length been obviated by the means secured by Mr. Blaxland's patent, the objects of which are not only an improvement in the structure and adaptation of the revolving apparatus, but in the mode of getting up the necessary speed.

The power of this propeller has been compared with the paddle-wheel in the only true way by which their relative advantages can be ascertained, viz. by making accurate trials *with the same engine, worked at the same rate, in the same boat,* and the result obtained exhibits an increase of speed with the propeller to the extent of half as much again as that produced by the paddle-wheel; the first attaining a speed of seven and a half miles per hour, the latter only five. In the best constructed paddle-wheels, assisted by build of vessel, the slip and loss of power has been supposed to be at least one-third; so that the gain of the propeller appears to attest not only its own excellence but the accuracy of this estimate.

These trials were made in the *Jane,* a whaling boat of 27 feet in length, 5 feet 3 inches beam, and three tons burthen. The engine used is of *less than one horse power,* whence it arises that the rates of speed, which are only quoted as decisive of the *comparative superiority* of the propeller, are in themselves but moderate.

It will, however, be heard with astonishment that this same boat, the *Jane,* with the same engine and propeller, has crossed the channel, from Dover to Boulogne,* in a very rough sea, with a head wind; and has also, under the like trying circumstances, gone round the coast from London† to Boston; and, by the internal navigation of the rivers Witham and Trent, to Nottingham. Thus have the experiments been fully carried out, and the advantages of the invention displayed in a heavy sea as well as in smooth water. The occasion of the latter voyage, in which Mr. Blaxland was accompanied by Captain Fairbairn, of the St. George's Steam Packet Company's service, was an invitation from the River Trent Steam Packet Company to the patentee to exhibit the propeller on that river, and so complete was the satisfaction it afforded, that instructions were immediately given by the company for building two iron steamers to be fitted with it.

Mr. Blaxland and his co-partners in the patent, having brought these facts under the notice of the Admiralty, they were led by the Lords Commissioners to expect that they would cause a trial of the new propeller to be made with one of the government steamers of 200-horse power; but perceiving, or thinking they perceived, a lack of promptitude on the part of the government authorities to give it this necessary trial on a large scale, they purchased the well-known commercial steamer *Swiftsure,* of about 130 tons burden, and 40-horse power, and fitted it up with the new propeller. Several experiments have since been made with this vessel, the results of

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* 13th Oct. 1840: see Boulogne Gazette of 19th Oct.

† Left London 13th May 1841; noticed at page 432 of our last volume.

which are in exact conformity with those obtained by means of the little *Jane.*

*The Leading Advantages claimed for this Propeller are :—*

*Increase of speed*—To the extent of *half as much again* in smooth water, and *greater in rough seas* in proportion to the liability of the paddle-wheel to be raised above the surface of the water; and as necessarily consequent to this, increase of speed,

*Reduction of current expenses*—It being evident that with an increase of speed to half as much again, there must be a *saving of one-third* in consumption of fuel, wages, provisions, and all other expenses dependent on the duration of a voyage.

*Improvement in Strength and Reduction of Width.*—The steam-vessel using the Propeller is enabled to adopt the build best calculated for strength as well as speed. The strength is increased by removal of the overhanging weight from the topsides to the lower part of the hull, and the vessel and engine are entirely relieved from all strain in pitching and rolling. In crowded ports, dock entrances, canals, and other narrow water-ways, the reduction of width becomes of most essential importance; while it also allows vessels to lie alongside of each other, or of quays, and removes the danger and difficulty attendant on boarding vessels from small craft.

*Absence of Swell, and disturbance of the Water.*—The propeller in the *Jane* creates no perceptible ripple, so equable and noiseless is its action in the water. And this advantage, which obviates the accidents so frequently attended with loss of life, also renders the use of this Propeller *harmless to the banks of canals*; and offers, in the *silence of its action*, a peculiar recommendation to its adoption for purposes of war.

*Security of the Propelling Apparatus*—From collision, or an enemy's shot. This is obviously gained in its position, it being placed *at the stern* of the vessel, and *below the water line.* Security of the Propeller from shot must be the first consideration in a steam-ship of war, while the removal of the paddle-boxes restores the range of her guns, and enables her to fire a broadside.

*The ease with which a combination of Wind and Steam may be provided.*—The Propeller, unlike the paddle-wheel, offers, when out of use, no obstruction to the progress of the ship under sail. It may be disconnected from the engine in a minute, when it revolves without causing any apparent impediment to the progress, by the action of the water upon it. This immediately suggests the great advantages with which it may be applied (in conjunction with an engine of comparatively low power) to merchant ships, men of war, &c., to be used only in cases of heavy sea, adverse winds or currents, calms, being disabled, or other emergency, as an assistance to sails; an advantage in long voyages too essential to need comment. The Propeller is not affected, like the paddle-wheel, by the heeling of the ship under a heavy press of canvass.

*The great facility of steering, and working the Ship round.*—Occasioned by the situation of the Propeller, and its action causing a steady current to act upon the rudder, whereby the vessel answers the helm instantaneously, and is consequently worked round in little more than her own length. The *Jane* can also be stopped in an instant, and the Propeller is equally efficacious in producing the reversed, as the forward motion.

*Removal of Tremulous Motion.*—This motion, so unpleasant in the use of the paddle-wheel, will be found entirely removed by the Propeller.

*Diminution of Weight and Space, and consequent saving in Tonnage.*—The wide difference between the weight of the paddles and their superincumbent appendages, and that of the Propeller and its gearing, and the reduced consumption of fuel above alluded to, secure important advantages in these particulars. Being relieved from strain, the engine for the Propeller may also be lighter built.

*Diminution of Expense in First Cost.*—Independent of the reduction of current expenses above shown, it has been estimated by an eminent shipbuilder, that a vessel adapted to this invention may be built for £1 per ton less than when constructed for the use of the paddle-wheel; to which is to be added the saving in prime cost arising from the simplicity of the Propeller and its gearing, compared with the paddle-wheels, shafts, &c., so that *the Propel-*

*ler may be provided, and license to use it obtained, at an expense much under what would be saved* by its substitution for the paddle.

*Explanation of the Engravings on the Front Page.*

Fig. 1. The after part of the *Jane*, with the propeller and machinery for getting up the speed attached. A, the first motion-shaft from the engine; B, the large, or driving drum, keyed on to the first motion-shaft, A; C, the intermediate friction-pulley for tightening the strap; D, the small driven drum upon the propeller-shaft, E; F, the strap; G, the propeller; H, opening in the dead wood.

Fig. 2. A section through Y Z; J, the nut for tightening or slackening the strap; all the other letters of reference correspond with fig. 1.

Fig. 3. A section through W X.

## ON MR. PILBROW'S ENGINE, AND THE CORNISH ENGINES, WITH REMARKS ON EXPANSION.

Sir,—It not unfrequently happens that a favourite scheme is so cherished and petted, so engrosses the thoughts, and I may say, the affections of a man, that at length the mind becoming injuriously heated, it is set up as an idol in the heart, and the judgment, and even the reason, as to this particular point, lie prostrate before it. It must be acknowledged that this is an extreme case, and is by no means intended to apply in the present instance, but still, there is a tendency to this result discernible in all ardent speculators. Mr. Pilbrow himself appears to be sensible of it, and very judiciously requests an opinion from others, as to the value of his improvements in the steam-engine. They were described in No. 930 of your Magazine. It is a pity that the enthusiasm of invention should have led either him, or Mr. Boyman, to advance the extravagant pretensions of being able to augment the duty done by the steam-engine, to double, and even treble its present amount, for the effect is too likely to produce a prompt and inconsiderate rejection of whatever may be useful in the invention. They should have asked themselves whether, in the present day, such a thing is probable, or even possible, especially as their improvements contemplate merely more advantageous mechanical arrangements, and not an increased development of power with reference to fuel, in which direction alone, any material increase in the efficiency of the engine, has of late years been obtained, or, since the time of Watt, was ever likely to be effected.

The alleged improvement consists simply in having a double action air-pump, as large as the cylinder, and in effecting the condensation in such air-pump, alternately on each side of its piston, whereby the available, and now nearly perfect vacuum is prepared *previously* to the stroke of the engine, and on the other side of the air-pump piston, than that where the condensation is going on. The idea is ingenious, and let it pass for what it is worth; let it pass, indeed, for what is claimed for it, namely, a gain of 1lb. on the square inch, arising from the superior exhaustion which is produced. But this does not content the patentee, he further claims "a saving effected by the steam piston, beginning its stroke with what is equivalent to a perfectly exhausted cylinder," and this he makes to be a clear gain of 3lbs., or at least, of 2¼lbs. more on the square inch, as compared with the very best performances of the present engine. Now I cannot understand this. Let it be admitted, for the sake of argument, that there is commonly a mean difference of 3¼lbs. on the square inch, between the cylinder and the condenser exhaustion, adverse to the efficiency of the engine, yet what has the patentee done to make it less? He has already taken credit for a superior exhaustion in the condenser, how is it to more than treble itself in the cylinder? The *difference* will still continue, whatever causes exist, in the slowness of condensation, or in the narrowness of the steam ways, to prevent an instantaneous escape of the steam from the cylinder: the same obstructions remain unaltered in the patent engine. If the communication between the vessels were made so free that an equal pressure obtained in each, then, indeed, whatever, owing to the slowness of condensation, the amount of that pressure may be, it would not militate in Mr. Pilbrow's arrangement against the efficacy of the engine, for it would act as much in aid as in

resistance, through the intervention of the auxiliary piston of the air-pump condenser. But such freedom of communication is not claimed as practicable, and if it were, it would not bestow an exclusive advantage on the patent engine, unless it resulted that no system of condensation could produce under such circumstances, a degree of vacuum equal to what is now obtained.

Either time or space is in some considerable degree indispensable for an evacuation of the cylinder to the standard of the condenser. Time is not merely the only admissible, but the only perfect means of obtaining this end, but Mr. Pilbrow's arrangement allows no longer time than before. In regard to condensation, the time may be prolonged, if it need be, by having two jets in action at once, but it is only in respect to such superiority, and not for any better evacuation that he can claim an advantage.

The Cornish pumping engines provide sufficient time for both operations to be fully perfected. The back stroke is comparatively slow, and a slight pause ensues before the commencement of the quick efficient stroke; thus the time, and the longer time, employed in every alternate stroke, is given to effect these very important objects of evacuation and condensation, so that the impelling force encounters no other resisting pressure from steam, than what is due to the temperature of the condensation. It is, in my opinion, on this point alone, that the superiority of these engines over what I think are very injudiciously called rotative engines depends; for the management of the fire, the construction of the boiler, the economising of caloric, and the advantage of expansion, are the same in that county for both classes of engines. The practical inference seems to be, that two single stroke crank engines, would be a better arrangement than a double stroke engine, for producing rotary motion. Whether this idea has been acted upon, I am not aware, but the mathematical delusion of loss of power by the crank, would not, I think, influence the decision amongst men of such sterling practical sense as the Cornish miners. Now that I am digressing on the subject of Cornish steam-engines, I would take the opportunity of inquiring whether there is not room occasionally for a fallacious estimate of the quantity of water raised, in those cases where the supply of water to the pump may be afforded through a long horizontal pipe, and probably of not very large dimensions. It is easy to see, that the inertia and friction of such a column of water, would only be sluggishly and partially overcome by atmospheric pressure, as *intermittingly* put in action by these pumps, and consequently, however excellent the state of the buckets, the actual delivery of the water may be considerably less than what would be due to the capacity of the stroke. The percussive force of steam has also been mentioned in connection with this subject. The fallacy of this idea is very apparent. However suddenly steam may be brought to bear upon the piston, it is very obvious, that the ultimate degree of pressure can be hastened only, and not augmented by the circumstance of time. Instantaneous action is not of itself percussion; momentum also must be present; but what, under the circumstances referred to, is the momentum of steam?

But to return to Mr. Pilbrow's engine, Mr. Boyman says, that "though it must not be confounded with Woolf's or Hornblower's, as an expansive engine, it may be found best in practice, not to let the injection condense the steam in the condensing cylinder, until the piston has made part of its stroke," by which I suppose he intimates, that an additional power may be derived from the expansion of the steam. It is singular it did not occur to him, that Mr. Pilbrow has not provided any room for the steam to expand in, subsequent to the efficient stroke, both of the cylinders being of the same size, and the pistons acting simultaneously.

To place the superiority of the condensing cylinder engine in a stronger light, the parties imagine the steam to be cut off at one-sixth of the stroke; they then compare the calculated duty with that done by an ordinary engine, when the steam is cut off at one half the stroke; and by thus mixing up the advantages supposed to be derived from extreme expansion, with those which their own peculiar arrangement is thought to afford, they arrive at the

conclusion, that "a passage to America which now requires 600 tons of coal, will by their engine require but little more than 200 tons." This is a strong light certainly for the subject to be placed in, but can it be said to be fairly illumined? It is first claimed, that the power gained is in the ratio of 5·67 to 9·00, but to raise it to the ratio of 1 to 3, they monopolise the (theoretical) advantages of expansion, which are open to all; but which to the extent they are claimed, belong more particularly to those who shall be fortunate enough to realise them.

A strange infatuation seems just now to prevail, respecting the amount of power that may be further developed from steam, by allowing it to expand to a greater extent than is usual. It appears to be forgotten, by those who dwell too implicitly on everything that savours of mathematical science, that steam is not a permanently elastic fluid, and is not wholly amenable to the law which connects the volumes inversely with the pressures. They forget, that the temperature of the steam is already at the lowest point compatible with its existence; but when it expands, caloric is necessarily absorbed; that condensation takes place; and that a diminution of pressure, correspondent to that of the temperature, ensues, independent of, and in addition to that which results from expansion. The reduction of the elastic force of the steam, is therefore far more rapid than is indicated by the hyperbolic curve; but what the curve is, which really represents the variation of pressure, is, I believe, utterly unknown to the mathematicians. Here again, they are found to be at fault, as in all questions of practice it is their fate to be; but it is of no consequence to the practical man, for it is always in his power to construct the curve empirically, and thus arrive at his object in this as in all other cases, by a short professional cut, without the assistance of the mathematician, and leaving him far behind. There are many practical considerations also which would speedily diminish any slight advantage that may theoretically belong to an extreme expansion of steam.

Misconceptions similar to this respecting the expansive power of steam, and arising from a similar cause, are by no means unfrequent. The tyro is misled by the exalted notions he entertains of the certainty and exactness that are promised to him in the deductions of science, and which will not permit him to pause and reflect how much of it may be purchased at the expense of the philosophy of the subject. A mathematical formula, however meagre may be its development, is a perfect *ignis fatuus* to some minds —"it dazzles to blind."

Your correspondent "S.," to whom Mr. Pilbrow appeals for a judgment on his engine, is well qualified, I imagine, to pronounce one, and also to correct his opinions and the opinions of other correspondents, as to the great advantages to be derived from a more extensive expansion of steam than is usually practised.

I am, Sir, yours, &c.

BENJAMIN CHEVERTON.

## ON THE ADMISSION OF AIR TO FURNACES.—BY C. W. WILLIAMS, ESQ.

[In continuation from p. 202.]

Sir,—In my last communication, I have spoken of the importance of attending to the mode, or manner, in which atmospheric air is introduced to the gases to be consumed in a furnace or lamp. In continuation, I will now add, that, supposing the gross quantity of air introduced to be chemically correct—say ten cubic feet of air to one of gas, (the exact proportion required for carburetted hydrogen,)—the effect produced in the furnace, whether it be good or bad, heating or cooling, (and it may be either,) will depend exclusively on the *mode* in which it is introduced, and not on the sizes or proportions of its several parts, as is generally supposed. Under this head, therefore, may be included the considerations of place, time, temperature, and diffusion; and to one or other of these will be found referable the various changes which take place, from the most cooling, accompanied with much smoke, and the escape of unconsumed gases, to that of the most heating, without smoke, and with complete combustion of those gases.

Here we see, is a wide range, and all referable to the same cause—the *mode* of introducing the air. And when

we inquire into the respective merits of the several plans for improving furnaces, it will be found that their comparative values will be exactly in the degree of perfection in the mode by which the air is admitted. The question, then, of perfection or imperfection in the use of coal as a fuel depends, first, on the *quantity* of air introduced; and, secondly, on the *mode* of its introduction. In fact, the whole is a question as regards the air; and not the dimensions, areas, or proportions of the several parts of a furnace or boiler. These, indeed, can furnish no certain or rational grounds for calculating results; since given areas or surfaces may, under one class of circumstances, produce results entirely different from those which would follow under another class. For instance, a given area of ash-pit, or bars, may admit quantities of air to pass at one time, that it would not at another. So, again, the same quantity of air will produce a heating or cooling effect, under the influence of different modes of introduction.

To begin, then, by calculating and laying down precise rules for those purely mechanical proportions in the several parts of furnaces and boilers, before we have examined, or understand, the complex chemical conditions to be satisfied, is manifestly beginning at the wrong end. It is a species of self-deception. It is reasoning from the abuse to the use; laying down a base of error and uncertainty, drawing inferences from results, and then taking these results as laws.

How, then, are we to begin? Let us first ascertain the quantity of gas to be generated and consumed—let us consider the supplying that gas with its due quantity of air—the administering that air in such a way that it shall aid the mechanical process of diffusion, and thus satisfy the chemical process of combustion. Let us provide that the air shall be brought into contact with the gases before the latter are cooled down below the temperature of chemical action; and that it be introduced in that place, where it will most favourably encounter the gases to be consumed, and where sufficient space can be obtained for the necessary expansion. These, and such like, having been duly considered, we are then, but not before, in a position to determine the most suitable proportions for the several parts of the vessels, chambers, or apparatus, in which the processes of combustion and evaporation are to be carried on; for these proportions will be right, or wrong, only as they minister to the effectiveness of such processes.

In my last communication, I enumerated the alleged results of the introduction of air, namely: that it "checks the generation of steam, cools the heating surface of the boiler, diminishes the draught through the fire-grate, lowers the temperature of the air in the chimney, lessens the intensity of heat in the fire-place, and diminishes the evaporative power of the boiler." Doubtless these evils are, more or less, the accompaniments of many of the modern "smoke-burning" patent inventions. I undertake, however, to show that, by a mere change in the mode of introducing the air, the required large quantity (and it is very large) may be rendered available; and, with one exception, produce results directly the reverse of those here enumerated. The chemical principles on which my suggestions are based are incontrovertibly established, are sanctioned by the first authorities of the day, and practically illustrated in the numerous contrivances for the improvement of our lamps. It becomes, therefore, a matter of no small interest, independently of its practical value, to ascertain in what the difference consists, which can produce such opposite results.

I assert that similar volumes of air may be introduced to furnaces of similar proportions, and yet, by *one mode* of introduction, produce all the injurious results above stated; and, by another, entirely opposite ones. The exception to what I have above referred to is, the allegation that the mode I propose "diminishes the velocity of the draught through the fire-grate." Now, so far from that being objectionable, it is precisely one of the important results which it is desirable to establish, and for the following reasons: this branch of the subject, however, being more fully considered in my treatise on "the combustion of coal."

Practical engineers, and many writers, as Tredgold, Armstrong, and others, confine the introduction of air to the direction of the ash-pit and bars. If, however, we consider the effect produced by the draught, in that direction, we shall perceive that any *excess* of air, so introduced, beyond what is strictly required for the use of the solid carbonaceous matter, must be attended with these injurious consequences, namely, the urging the combustion of that solid part of the fuel faster than is judicious, or compatible with the combustion of the evolved gaseous matter; and deteriorating the air intended for the gases, by depriving it of much, if not all, of its oxygen. Such writers are thus chargeable with this singular inconsistency, that, while they admit pure air to be essential to the combustion of the gases, they nevertheless deny the policy of introducing it in any other place than by the ash-pit, which, at the same time, they acknowledge must render it impure and deteriorated. Mr. Armstrong observes, that his chief objection to the numerous plans for "burning the smoke" is, "that they nearly all require the admission of a large quantity of cold, undecomposed atmospheric air direct to the chamber of the furnace, that is, air which has not passed through the ignited fuel on the fire-grate, and, consequently, containing its full supply of oxygen." He does not, however, say in what other direction the air should be passed to the combustible gases, except "through the ignited fuel on the fire-grate;" and by which, as he correctly implies, it would be deprived of its oxygen, and be no longer pure, ("undecomposed," as he terms it.) This is the great omission which I charge against the common practice of the day, and which leads engineers aside from the really important points in the inquiry.

If, however, we confine the supply of air through the ash-pit to its own proper duty, and convey the supply which is to effect the combustion of the gases by a different direction, we shall thus provide both parts of the fuel with their due and respective quantities. The effect would be, that although less air would be passed by the ash-pit and bars, thus "diminishing the draught" in that direction, still, a much larger quantity would, on the whole, be brought usefully into action, than if the entire supply was introduced in the one direction alone. We see, then, the importance of duly considering the *mode* by which the air should be introduced, independently of the *quantity:* and, if there be any truth in chemistry, whatever will effect a more perfect combustion of the gases, and a larger absorption of oxygen from the air, must produce a greater development of heat in the furnace, as it does in the lamp.

Again, if we reflect on the fact, that for effecting the combustion of the gas evolved from every ton weight of coal, there is an absolute demand for 120,000 cubic feet of air (independently of the supply required for the solid carbonaceous residue, taking that at about double that volume:) we can readily appreciate the importance, and practical value of attending to the *mode* by which the large supply may best be introduced. And to what are the numerous and admirable contrivances for improving our lamps and burners attributable, but to the very point I am now considering; namely, the most effective *modes* of bringing the air to the gas; and I would here particularly allude to the "Solar Lamp."

But why apprehend any injurious effects from the principle of introducing a body of air to the gases issuing from a furnace? If we are not fearful of such effects as regards the lamp, why be so as regards the furnace? Why overlook the identity of the two processes? How can the combustion of the gases be carried on without this contact with pure, "undecomposed," air; and which it is admitted cannot be pure, and undecomposed, if it "passed through the ignited fuel on the fire-grate?" What is it generates the powerful heat from the Argand burner which I use in my laboratory; and what is it gives perfection* to that burner, and increases the intensity of its heat, but the *peculiar mode* by which the air is brought into contact with the gas? the very circumstance which is least attended to as regards the furnace.

After *quantity*, then, all depends on the *mode;* and this, in its turn, depends for perfection on the degree in which it satisfies the primary law of diffusion and combustion; namely, that no greater

quantity of gas and air be brought together, than can chemically combine, as their respective atoms come into contact.

If time be allowed, nature will produce this atomic diffusion; but as we have not time in the furnace—the gases flying off as fast as generated, the perfection of the *mode* will lie in the satisfying this law before it be too late. If this law be not satisfied, a cooling effect, instead of a heating one, will be produced: for air not employed in producing heat, will, by absorbing it, produce cold. There is no neutral state: and every atom of air introduced, if not useful and necessary, must be prejudicial.

At a further opportunity I will more particularly describe the mode by which the air should be introduced, and the adjustments in the furnace to give it a practical application.

I am, Sir, yours, &c.

C. W. WILLIAMS.

Liverpool, August 28, 1841.

NOTE TO MR. PRATER'S ESSAY ON INHERENT ACTIVITY, IN REFERENCE TO MR. WIGNEY'S OBJECTION. — MECH. MAG., VOL. XXXIII, P. 35.

Sir,—Mr. Wigney has objected to the Essay in question, that matter *per se* is inert, and that *the addition* of heat is always the cause of its motion. I have already elsewhere considered Mr. Wigney's objection *in detail*, and, as I think, shown, that such opinion is untenable: I shall here, therefore, only allude to this opinion in its *general sense*, and show, that with some *modification*, Mr. Wigney's opinion is not so dissimilar to my own, as it at first sight appears: at least, I do not deny the assertion, that the addition of heat is a cause of motion; I only assert, that matter has a power of motion, independent of any *addition* to its natural, or latent heat. In note, p. 510, I have said, "All matter requires some degree of heat, to enable it to move;" and again, further on, in the same note, "Is not heat the moving power in all these cases, and have not gases the greatest tendency to motion, because they contain most heat?"

Now, by attention to these passages, it will be seen that I regard the heat *already* and *necessarily* existing in matter, as in all probability the cause of its inherent activity. But Mr. Wigney seems to consider that in all cases where the particles of matter are put in motion, there is an actual *addition* or *impartation* of caloric. Now that this is not the case, is shown by carbonic acid and hydrogen, moving through each other, although they are not heated. Their motion I consider, therefore, to depend probably on their *latent* heat; on that degree of heat which is absolutely essential to their existence as gases.

My reasons for this opinion are as follows: carbonic acid has been congealed; it is hence probable, that by a certain degree of pressure, united with cold, all other gases might be reduced to the solid state. And it is also probable, that were the surrounding air made equally cold as the carbonic acid, that gas would *remain* in a state of congelation, deprived of all its *usual* affinities,* and also of its *diffusive power*, since, for the existence of this, it seems necessary that it be in the gaseous state.

Taking this view of the subject, *latent heat* would appear to be the principal, if not the sole cause of all motion in matter; for were the *whole globe* brought considerably below the freezing point, there would be no motion *in any part* of it, for its water would be ice, and its air would, after the lapse of ages, probably also become congealed, or otherwise completely changed.

The theory of *latent* heat being the cause of "inherent activity" of the diffusive power of the gases "is supported by the fact, that the latent heat of water is so much less than that of steam; that of water being only 140°, while that of steam is 1000°. It hence seems probable, that had we accurate knowledge on this subject, we should find the latent heat of all vapours, (and consequently gases,) much higher than the latent heat of the same in the fluid state; that the diffusive power, or inherent activity of

* In this view of the subject, heat comes to be also the real cause of chemical affinity; for if *all* matter were at the lowest degree of heat, its usual affinities, — affinities as at present, — would be changed.

steam is much greater than that of water: such is likewise the case with that of gases generally, compared with fluids. It is hence probable, that in *all* cases where the latent heat of a substance is increased, or when its latent heat is materially greater than that of another substance, that its inherent activity, or "diffusive power," is greater. Nevertheless, the nature of the matter may also have an influence, as well as heat, in disposing to inherent activity. Thus, I have observed in the Essay in question, that generally speaking, the lighter the solid, fluid, or gas, the greater its inherent activity. Now heat almost always increases the levity of matter, by removing particles to a greater distance from each other, and in this way is the great antagonist power to cohesion and gravitation. So far, therefore, heat again, in this way of viewing the subject, is the cause of inherent activity; but as it is likewise probable that some forms of matter are lighter than others, independent of the heat they contain, so it seems probable that inherent activity is, *in some small degree*, independent of the latent heat of matter. But the present state of science only allows us to offer conjectures on this point. That the *addition* or *impartation* of heat is a cause of motion in matter, is obvious. Mr. Wigney is no doubt correct in making this assertion, but he seems to me to be incorrect in confining (as he appears to do) all motion in matter to the *addition* of heat; for the addition (perhaps even the subtraction) of electricity from matter, is likewise a cause of motion; and the diffusive power of the gases, if it arise (as seems probable) from heat at all, arises, not from the *addition* of heat, but from the great *latent* heat they probably all possess, and which they cannot lose without becoming liquids or solids, and thus altogether changing their nature.

H. P.

## PENN'S OSCILLATING ENGINES—CORNISH ENGINE AT THE EAST LONDON WATER-WORKS, &c.

Sir,—I have often wondered that our builders of marine engines have never adopted the improvements that have been made in the Cornish engines, and also that they have not adopted in their larger boats, Penn's Vibrating Engines, which are so successfully used in the iron boats that ply up and down the river—those especially above bridge. I am surprised to find many mechanics ignorant of their existence: talking the other day to an intelligent *boiler maker*, I found he knew nothing about them. The engines supplied by Messrs. Seawards for the *Gorgon*, (plans of which I recollect seeing in your Mag.,) I thought were a beautiful specimen of human ingenuity, but I certainly think they are surpassed by Penn's Vibrating Engines.

You state in your review of Mr. Russell's book, a foreigner would be obliged to travel to Cornwall to see our improved engines; but if I am not mistaken, in one of your notes at the end of the *Mech. Mag.*, you announced at the time, the arrival and completion of a Cornish engine for the East London Water Works Company, at Bow, consequently he might walk, and not tire, and see the improved engine. There, also, would your correspondent "Mercury" see one fact, which is better than all his reasoning, viz, a Cornish engine doing as much duty on the surface of the earth, as it did in the mines from which it was taken! To which, perhaps, he will allow me to add another—as he makes out the engine does less work, in consequence of the attraction being less (opposing itself)—How is it that a Boulton and Watt's engine will not do as much, when it is of equal power, and applied to the same work? His reasoning would be just, if the comparisons of duty had been between a Cornish engine in the mine, and a Boulton and Watt at the surface; but they are not so made: both have the same work to do, and the Cornish engine does most; how, then, can he think to explain the reason by our old theory of gravitation? I do not wish to ridicule his objections, but the two facts so oppose his reasoning, that I could not help stating them. It is much easier to account for the improvement of engines than to change what is believed by most to be a natural law, especially when the Brothers Lean report their

progress as being in 1814 doing an average duty of 20,000,000, and in 1835, above 60,000,000. Mr. Wicksteed accounts for their superiority by the following reasons—1. Radiation of heat in boilers and cylinder is prevented by non-conductors, saw-dust, or cinders.—2. Extent of flue surface, being $\frac{5}{6}$th of the whole of the boiler.—3. Slow combustion of fuel.—4. High pressure of steam, being from 30lbs. to 50lbs. on the square inch—5, and lastly, using the steam expansively, by cutting off its entrance at a sixth of its stroke.

Mr. Wicksteed shows that the use of a Cornish engine, in lieu of those made by Boulton and Watt, causes a saving of 70 per cent. per annum; this ought to be sufficient inducement to our engineers to adopt the means by which such a benefit is consummated. Penn's principle, with the Cornish improvements, will make the steam-engine a power, for compactness and efficiency, *scarcely* to be surpassed by electro-magnetism, which will, I think, eventually supplant it; indeed, I wonder it has not made more progress already, seeing such enormous power can be generated at so trifling an expense. I will at some future day, if you will accept it, send you a plan which will, I doubt not, advance electro-magnetical science a little, with also a few hints on other matters; at present I have only to apologize for the length of my communication, assuring your readers I am not personally interested in any of these matters, being neither shareholder, engineer, nor mechanic, but a true lover of all useful inventions, and,

Your obedient servant,

D. J.

August 26, 1841.

[We shall be happy to receive our correspondent's preferred contribution to Electro-Magnetic Mechanics. Ed. M. M.]

## THE THAMES AND CLYDE STEAMERS.

Sir,—Various circumstances having occurred to prevent my paying earlier attention to the two communications of Rufus, and A. M., which appeared in your Magazine some little time since, I am now compelled, though late in the day, to solicit your indulgence in making a few remarks vindicatory of my former letter. If my letter had contained unjust reflections on, or odious comparisons of, the Clyde steamers with those of the Thames, some little justification might have been found for the soreness with which A. M. finds fault with me for having, after all, bestowed the praise on those to whom it is due, as he himself must, after the recent trials of the *Wallace* and *Burns*, in fairness acknowledge. But as such was not the case, A. M. had no right to charge me, as he has done, with gross and blind partiality. I leave your readers to judge to whom that charge most justly belongs. This is not the first time the Thames and Clyde steamers have been discussed in your Magazine, nor will it be the last; but for the present I leave A. M. to enjoy the excellent *exposé* each of his crack vessels has received in the letters of Mr. Bayley, and L. P. I now turn to the letter of Rufus: this gentleman wishes to know what is the pressure used on board the *Brunswick*, *Railway*, and *Blackwall*; I cannot give him exact information on this head, but I have every reason to believe that it is not much above the usual pressure used on board all Thames-going steamers, and certainly not more, if so much, as that on the Clyde. The imputation that Rufus has thrown out, viz., that such men as Messrs. Seaward, Messrs. Miller and Co., and Messrs. Penn, have used an unfair means to obtain such great speed for their boats, as an individual, well known for the *Victoria*, and other steam-boat catastrophes, used to do, is unfair and untrue in the extreme. If Rufus does not know, except from vague unworthy sources, anything of these boats, why circulate such preposterous stories as he has done with respect to their pressure, and more particularly with regard to the *Brunswick*, whose boilers, he says, were ruptured under unusual pressure, which is not exactly true? The facts are these: that while on one of her voyages a defective steam-pipe gave way, and having filled the engine-room with steam, and compelled the engineer to quit it; the captain, without inquiry, concluded an explosion had taken place, and ran the vessel ashore, thereby creating both unneces-

sary alarm, and great delay to the passengers.

I remain, yours, &c.,
NAUTICUS.

August 31, 1841.

### THE SLIDING RULE.

Sir,—If you will accept a somewhat tardy answer to the inquiries of L. R. vol. xxxiv. p. 111, I will endeavour to be brief.

The patent sliding rule is noticed in 1798 by the Rev. W. Pearson, in a communication to Nicholson's 4to Journal, vol. i. His description shows that it is of the same kind as that which I once saw, and which L. R. mentions. I never met with the name "Bradford and Hull" until now. The "reversed radius" on one side of the slip of brass is to solve the equation $x = \frac{abc}{d}$ at one operation, see *Mech. Mag.* vol. ii. p. 299. The graduation on the other side of the brass is for the solution of right-angled triangles, see *Mech. Mag.* vol. xxxii. p. 102.

Mr. Bateman, in his "Excise Officer's Manual," 1840, was particular in assigning the origin of the different improvements made in the excise rules, but he states, p. 176, that he had not succeeded in tracing the author of the line M D; your correspondent appears to have been more fortunate.

To conclude, I am ready and willing to supply all that L. R. wishes for, in the last paragraph, but I want a publisher; I do not intend to print on my own account.

I am, &c.
J. W. WOOLLGAR.

Lewes, Sept. 1, 1841.

### ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

*** *Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for that purpose.*

GEORGE EDWARD NOONE, OF HAMPSTEAD, ENGINEER, *for improvements in dry-gas meters.* Rolls Chapel Office, August 18, 1841.

The upper part of the meter is divided into two compartments by a flexible diaphragm of leather or other suitable material, which is fastened to the casing by a metal ring; a jointed lever is connected to the centre of the diaphragm, by which motion is given to the working parts placed on horizontal axes at the bottom of the meter. The ingress and egress pipes,—that is, the communications between the gas main and the meter, and between the meter and the burners—are governed by a four-way cock, the plug of which is acted upon by a bent lever, through a weighted cam or tumbler, so as to reverse the communications every time that the diaphragm is forced over to either side by the pressure of the gas; every such movement being recorded by the registering apparatus.

In order to prevent gas from passing through without being registered, when the meter is placed in an inclined position, the weighted cam is provided with two pins, the uppermost of which is nearly embraced by the forked end of either of two small weighted levers when the meter is in a vertical position. But if the meter is inclined to either side, the weighted end of the lever on that side tilts up its forked end and embraces the pin, thereby preventing the motion of the cam, consequently the supply of gas is shut off from the burners, until the meter is again restored to a level position.

A second improvement relates to a method of manufacturing the flexible diaphragm used in this form of meter. A mould is used consisting of several segments of hard wood joined together at the centre, and so constructed as to admit of a wedge-piece being inserted between them in order to expand them, and complete the hemispherical form required in the mould. The flexible material is placed upon the mould in a damp state, and tied round upon a metal ring which it encircles. The wedge-piece is then forced between the segments by means of thumb-screws, until the proper form is obtained, when the flexible material is left to dry, and then removed from the mould

The claim is to the spirit and legitimate scope of that, which, as a principle of construction, has been set forth in this description: excepting such parts of the apparatus, or mechanism as have been known and used before, and which, for the sake of perspicuity, have been necessarily alluded to.

WILLIAM NEWTON, OF CHANCERY-LANE, CIVIL ENGINEER, *for improvements in the process of, and apparatus for purifying and disinfecting greasy and oily substances or matters, both animal and vegetable.* (A communication.) Rolls Chapel Office, August 22, 1841.

These improvements, which are twelve in number, are briefly as follows:—

1. In the decoloration or disinfection of

fatty matters, by a partial or total distillation in vacuo.

2. In subjecting fatty or greasy substances to the action of currents of steam, heated to a temperature of above 100° of the centigrade thermometer.

3. In distilling acid fatty matters with a current of steam of a high temperature to obtain the acids in a state of purity; and also by using the same means with fatty matters previously heated to produce the acids more pure and more economically than heretofore.

4. In clarifying heated fatty matters, by means of sulphuric acid, and subsequent washing with water; the fatty matters being afterwards separated from the water and acid by injecting into the mixture currents of steam at from 60° to 100°. The operation of washing is continued until the water is not discoloured, when the fatty matters are thrown, while warm, into a filtering apparatus.

5. In decoloring fatty matters by means of lime, chalk, and alumine, either in a rough or purified state, employed in a dry state, and heated to 100° and upwards.

6. In a form of apparatus for heating fatty substances uniformly and economically, either with or without steam, and for collecting the products disengaged during the several operations.

7. In an apparatus for operating upon fatty substances in vacuo, either by heating and distilling them alone, or by a current of steam.

8. In the employment of steam not compressed, but heated above 100° of the centigrade thermometer, as described under the 2nd improvement.

9. In several new arrangements of filters for filtering oils and fatty matters.

10. In the use of such filters, of mineral or vegetable acids, and acid salts, of absorbent and decoloring materials, and of textile substances steeped in alum to assist in producing the effect desired.

11. In employing platinum, or silver worms for condensing the distilled acid fats, &c., by which the acids are obtained in a state of perfect purity.

12. In the distillatory rectification of acid fatty substances for the purpose of separating the liquid from the solid parts thereof, without the use of pressure.

Jonathan Guy Dashwood, of Ryde, Isle of Wight, Plumber, *for improvements in pumps.* Enrolment Office, August 22, 1841.

Within one long or three short cylinders, two long buckets fitted with valves in the usual way work up and down; each bucket is twice and a quarter the length of the stroke, and is worked by slings attached to its outer side, between the working cylinders or through suitable openings in the cylinder where one only is used. The ends of the buckets are made to fit the cylinders in a water-tight manner, by means of cupped leathers. The working cylinder slings and buckets are enclosed as high as the top of the former within a casing filled with water, to keep the leather moist, and to prevent the access of air to the buckets.

The slings are each attached to a separate crank shaft, on which an eccentric cog-wheel is fixed, driven by an intermediate wheel on a horizontal shaft; so that the cogs on the longest leverage of the driving wheel fit into the short lever cogs of the one wheel, and the short lever cogs of the driving wheel into the long lever cogs of the other wheel. So that on turning the driving wheels regularly round, the buckets will be raised and depressed alternately, thereby maintaining a constant flow of water.

The claim is to the introduction of the long buckets and the method of working the same, by the slings being fixed to the outside of them after passing down outside of the working barrel.

Also the introduction and use of eccentric wheels for pump work, so as to give that peculiar action to the crank-shafts, by causing them to travel at different rates of speed during each revolution of the driving wheel.

John Henry Le Keux, of No. 37, Southampton-street, Pentonville, Engraver, *for an improvement in line engraving, and in producing impressions therefrom.* Rolls Chapel Office, August 23, 1841.

This improvement consists in engraving a subject on two plates, one portion of the subject on one plate, and the remainder on the other, so that when printed, the combination of the two impressions shall produce the effect required.

Two plates being prepared for engraving, on one of them is put a tracing of any given subject. The outline and dark shadows are then etched on this plate, and finished by the usual process of line engraving; this plate is called the subject plate.

A tracing, or transfer from the above is then placed on the other plate, and a tint of lines is ruled all over the subject; the lights are then stopped out, and the under tints, or shadows are produced by biting in; thus forming what is called the ground plate. The plates being marked with register lines are printed, one upon the impression of the other, so as to produce the effect sought.

The claim is, to the ruling of a tint of lines, and then producing the required under tints, lights, or deep shadows, on a separate plate from that on which the general subject

is engraved, and then taking impressions from the two plates so engraved in the manner described (both being engraved in the style called line engraving), whereby an entirely novel effect is produced, with a considerable saving of labour.

JOHN DEANE, OF DOVER, CHEMIST, *for improvements in preparing skins and other animal substances, for obtaining gelatine, size, and glue, and in preparing skins for tanning.* Petty Bag Office, August 23, 1841.

The hair is first removed from the skins, by placing them in a solution of lime, potass, or soda, in the proportions of from 8 to 26 lbs. of lime, and from 4 to 16 lbs. of potass or soda to every fifty gallons of water. The skins are then placed in a revolving cylinder formed of bars of wood or metal, or a perforated surface of wood may be used, and the cylinder being placed in a trough filled with any of the before-mentioned solutions is caused to revolve until the action of the lime, &c., aided by friction, has removed all the hair. The skins are then taken out of the cylinder, fleshed or shaved, and washed until thoroughly cleansed. They are then steeped in a large vat of water, until a slight putrescence is apparent, when they are removed to suitable vessels, and covered with water, into which is poured from 6 to 28 or 30 lbs. of hydrochloric acid for each cwt. of animal substance. The vessel is then covered over, and the skins left to the action of the acidulated water from eight to twenty-four hours, or until the skins assume a white semi-transparent appearance, when they are taken out and thoroughly washed in cold water, and afterwards deposited for two or three days in a tank, through which a current of fresh water flows continually. Instead of the hydrochloric acid in solution, the skins may be treated with hydrochloric acid gas.

Hides, &c., are subjected to the above processes, and then tanned in the ordinary way.

The claim is to the use of a rotating perforated or other cylinder, for the purpose of unhairing the skins, hides, or pieces, to be used in the manufacture of gelatine, size, or glue; when used in combination with a solution of lime, potass, or soda, or combined portions of either. Also, the application of hydrochloric acid, or hydrochloric acid gas, or either of them diffused in water, in whatever manner they may be employed; when applied to hides, skins, or other animal substances, for the purpose of preparing them for the manufacture of gelatine, size, or glue. Also, the sole application of the above-mentioned acid and acid gas to hides and skins, for the purpose of preparing them for being tanned.

CHARLES SNEATH, OF NOTTINGHAM, LACE MANUFACTURER, *for certain improvements in machinery for the making or manufacturing of stockings, or other kinds of loop-work.* Petty Bag Office, August 23, 1841.

The machine embodying these improvements consists of a rectangular frame, on the front rails of which there are two sets of brackets, which carry the principal working parts. In the front part of the machine, a series of vertical jacks or levers vibrate upon a horizontal shaft, between combs which are fixed to the lowest set of brackets. A lead with two needles is jointed to the upper end of each jack, the leads sliding in and out horizontally upon the top rail of the machine; the lower ends of the jacks are acted on by springs, which, pressing against their tails, force their lower ends back, and thus cause the needles to project forward. The tails of the jacks are acted upon by a series of tappets, set as oblique steps on the periphery of a barrel or cylinder mounted on a horizontal shaft in the middle of the machine. The bobbin of thread for the production of the fabric is placed at the top of the machine, from whence the thread passes down through the eye of a carrier to the needles.

To the front ends of the upper set of brackets a lever frame is jointed, carrying a bar, to which a series of points set in leads are attached. These points stand between the needles, and are used instead of the ordinary sinkers, for forming the loops. Two other levers, carrying a presser bar, are also jointed to the same brackets, to the under part of which a vertical bar, called a stump bar, is fastened, its upper edge being cut into notches, between which the needle slides to and fro; in front of the stump bar, below the needles, a thin plate, called the freeing plate, is attached, a space being left for the passage of the work to the work-beam below.

In the drawings which accompany the specification, a double machine is represented, containing two sets of working parts, the one in the front, the other at the back, working simultaneously, and producing two pieces of fabric at the same time.

JOHN GODWIN, OF CUMBERLAND-STREET, HACKNEY-ROAD, PIANO-FORTE MANUFACTURER, *for an improved construction of piano-fortes of certain descriptions.* Enrolment Office, August 23, 1841.

The improvements here patented relate to the construction and arrangement of the different parts of horizontal pianos, the strings of which pass from the plate over the bridge on the sound-board in the usual manner, and under a bridge beneath the wrest-pin block. The strings are each passed round a separate pulley, and are then carried up in front of the block to the wrest pins, and are secured in the usual way. These pulleys are made in sets, according as the instrument is to

have two or three unisons, and the mounting of each set has a shank attached to the lower angle of the front of the wrest-pin block, which is cut away for that purpose. The wrest-pin block is of a rectangular form, (8 inches wide, and 4 inches deep,) and is composed of two pieces; the lowest of which is cut away to admit a strap on one end of a bar, the other end of which is attached to the string plate. There are several of these straps, which are let in to counteract the tendency of the tension of the strings to depress the front and elevate the back of the wrest-pin block. For this purpose, an iron bolt, $\frac{3}{16}$ of an inch in diameter is also passed through each bar, through the sound-board and bracket, and secured above the bar by a nut, and beneath the bracket by a washer.

The sound-board is placed three inches and a half below the strings, and is extended two inches farther than usual towards the front of the instrument, under the vibrating part of the strings. This extension may be carried through the whole length of the scale, but it is preferred to go only as far as where the treble notes do not require dampers.

In order to effect the action of the key upon the hammer and damper, under this arrangement, the damper level is placed between the sound-board and the strings, and the bracket is made quite straight. The key is shortened about two inches, and a right-angled piece of metal fixed on the end of it communicates the action of the key to the damper lever. The check is carried farther back on the key, and a check piece is attached to the middle of the shank. The hammer rest is also removed higher up, and the length between the head and the shank of the hammer is reduced to an inch.

John Walker, of Crooked-lane, King William-street, *for an improved hydraulic apparatus.*—Enrolment Office, September 8, 1841.

This apparatus was fully described in our 927th Number,* as a single tube, with a valve in an enlarged chamber at its lower end, and its *modus operandi* explained. The patentee observes in his specification, that when water, or any other fluid, is merely to be raised into a cistern, and not delivered in the form of jets, an elbow pipe is substituted for the jet-pipe.

When a continuous flow of water is required, the upper part of the moveable tube, instead of being equipped with the jet-pipe, has a leather, or other flexible pipe screwed on to it, the other end of which is inserted into a fixed air-vessel, and closed by a valve opening upwards; the intermittent jets are collected in this air-vessel, and compressing the air contained therein, the water, or other fluid is forced out by the reaction of the compressed air through a discharging orifice, in one continuous stream.

When large quantities of water have to be raised, as for example, from reservoirs for the supply of houses, or from flooded lands, two or more of these machines may be suspended from the extremities of an equal armed lever, so as to counterbalance each other, and deliver the water alternately, being worked by suitable machinery, impelled by manual labour, or any other available power.

The claim is, 1. To the improved hydraulic apparatus, of the form hereinbefore described, and deriving its power of raising and projecting water, or any other fluid, in the manner set forth, however such may be worked, whether by manual labour, or by suitable machinery moved by steam, water, or any other power; and whether used in a vertical, inclined, or horizontal position.

2. To the said apparatus as used in connection with an air-vessel for obtaining a continuous flow of water or other fluid, or in connection with any other appendage, by which its applicability as a machine for raising or projecting fluids may be varied, facilitated or extended.

* Vol. xxxiv., p. 377.

## IMPORTANT COMBINATION OF THE ELECTROTYPE WITH THE DAGUERREOTYPE PROCESS.

At the last meeting of the London Electrical Society, a paper was read by Mr. W. B. Grove. M.A., F.R.S., Professor of Experimental Philosophy in the London Institution, "On a Voltaic process for etching Daguerreotype plates," which contained an account of a series of experiments, that promise to lead to most important results. The paper was illustrated by 20 or 30 prints obtained from the etched plates, by the etched plates themselves, and by electrotype copies of the same. The principles on which the process depends may be gathered from the words with which the author concludes:—"Instead of a plate being inscribed as 'drawn by Landseer, and engraved by Cousins,' it would be 'drawn by Light, and engraved by Electricity.'"

"The secret of this process is to make the daguerreotype the anode of a voltaic combination, in a solution which will not of itself attack either silver or mercury, but of which, when electrolyzed, the anion will attack these metals unequally." This is accomplished by employing a solution of two measures of hydrochloric acid to one of water, and placing it in the daguerreotype plate as an anode, with a plate of platinized silver of equal

size as the other electrode. The result of the unequal action of the liberated anion upon the plate, is to produce a perfect etching of the original design; and this, when printed from, gives a picture, having the lights and shades as in nature. From the nature of the case it will ensue, that if the plate is etched too deeply, the fine lines will run into each other; but if sufficiently acted on to leave a perfect etching of the original design, which can be done with the greatest accuracy, the very cleaning of the plate by the printer destroys its beauty, and the molecules of the printing ink being larger than the depth of the etchings, a very imperfect impression is obtained. From this the author concluded that at present the great object attained is this,—a daguerreotype picture can be produced in the ordinary way, it can be etched according to the present process, and from this etching, an indefinite number of electrotype copies can be obtained. As an illustration of the perfection attendant on this, the author states, that from a daguerreotype plate, which had on it a sign-board measuring 1-10 by 6-100 of an inch, five lines of the inscription can be read distinctly by aid of a microscope applied to the electrotype copy. The author mentions many advantages attendant on his mode of etching, among which not the least worthy of attention is, that local action is avoided.

## NOTES AND NOTICES.

*Cornish Engines.*—The number of pumping engines reported upon in Messrs. Lean's Monthly Report for July last, is 51. They have consumed in that time, 3,440 tons of coal, and lifted 33,000,000 tons of water 10 fathoms high. The average work of the whole is therefore 51,000,000lbs. lifted one foot high by the consumption of one bushel of coal. The greatest individual performance during the past month, has been that of Taylor's South Wheal Basset Single Engine, (86 inches cylinder, and 11 feet cylinder stroke,) which raised the enormous quantity of 101,595,300lbs. of water, by the consumption of one bushel of coal.

*Safety Gunpowder.*—A process is stated to have been submitted to the French Academy of Science, by which gunpowder can have the property of inflammability abstracted from, or imparted to it, at pleasure, so that it may be stored up in any quantities, with as much safety as oil or corn.

*Immense Iron Tent.*—The King of Prussia has had a tent made, for the purpose of giving a grand entertainment at the Camp in Silesia, the framework of which is all of cast-iron.

*Spontaneous Combustion.*—Mr. Robert Hunt, who has been engaged in an inquiry into the origin of the fire that broke out some time ago in H.M.S. *Talavera*, has reported to the Admiralty, that it was owing to the spontaneous ignition of masses of oiled oakum, oiled and painted canvass, and sawdust, which had been allowed to accumulate in a large bin on the edge of the dock, immediately beneath the roofing under which the ship lay.

*Steamers for the Sicilian Government.*—On the 21st inst. a fine steam vessel was launched from the building yard of Mr. Pitcher, of North Fleet. She is for the Sicilian government, and named the "Maria Teresa," her tonnage is 300, and the collective power of her engines, which have been manufactured by Messrs. Boulton, Watt and Co., Soho, will be equal to 120 horses. A second vessel is in considerable progress for the same government to carry 250 horse engines from the same establishment.

*Electrotype.*—The Bavarian sculptor Stigelmayer has brought to great perfection the galvano-plastic process. In the space of two or three hours colossal statues in plaster are covered with a coat of copper, which takes with the greatest accuracy the most minute and delicate touches, giving the whole the appearance and solidity of the finest casts in bronze. M. Stigelmayer has also applied his process to the smallest objects, as flowers, plants, and even insects, bringing them out with such accuracy, that they seem to have been executed by the hands of the most skilful artists.—*Letter from Munich.*

*Alkali Works.*—There is a process now in operation to destroy entirely the muriatic and other baneful gases that have hitherto made their escape from chemical works, to the great injury of vegetation and health. Messrs. Burnett and Sons, of Dunston, the original inventors of this process, have had their alkali works in full operation on this principle, from two to three years, in the heart of a rural district, without having had a single complaint from their neighbours, or a single shilling to pay for damages.—*Northern Times.*

*The Welsh Coal Fields*, it has been stated, extend over 1,200 square miles, and that there are 23 beds of workable coal, having an average thickness of 95 feet. Each acre will yield about 100,000 tons, being at the rate of 65,000,000 tons per mile. If from this we deduct one half for waste, and the minor extent of the upper beds, this will afford a supply of coal equal to 32,000,000 tons per square mile. Let it be conceded that 5,000,000 are equal to one-third of that consumption in England—then each square mile of the Welsh coal field will meet a proportionate consumption of 100 years; and as there are from 1,000 to 2,000 square miles in this district, it would supply England with coal for 2,000 years after all the English mines were exhausted.—*Times.*

*Ancient Water-wheels in the Euphrates.* — The only obstacle to the navigation of this river consists in the remains of the water-wheels used for irrigation. In the short space of 130 miles we found nearly 300 of these wheels, about one-third of which are in operation at the present day. They consist of large parapet walls built into the stream, directing the current of the river to the wheels, which are the most clumsy pieces of mechanism, made of branches of trees, and having slung round them 150 clay vessels to raise the water in. The wheels are 40 feet in diameter, placed at the end of an aqueduct, raised upon well-built Gothic arches. They are the nearest approach to perpetual motion that I have seen, and it is surprising the quantity of water which they raise to the surface. They cause a current of six or seven knots, with a fall of two or three feet where they are, so that this part of the river is difficult, and somewhat dangerous; but, as it is, we have surmounted all; I should rather say the genius and skill of Messrs. J. Laird and Macgregor, who furnished the boats and engines, have overcome obstacles which baffled the well-disciplined legions of Trajan and Julian, when they went to besiege Ctesiphon, and failed to drag their fleets against the stream on account of the current. *Account of the Euphrates' Expedition in the Times.*

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# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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## MAY'S RAPID FILTER.

Fig. 1.

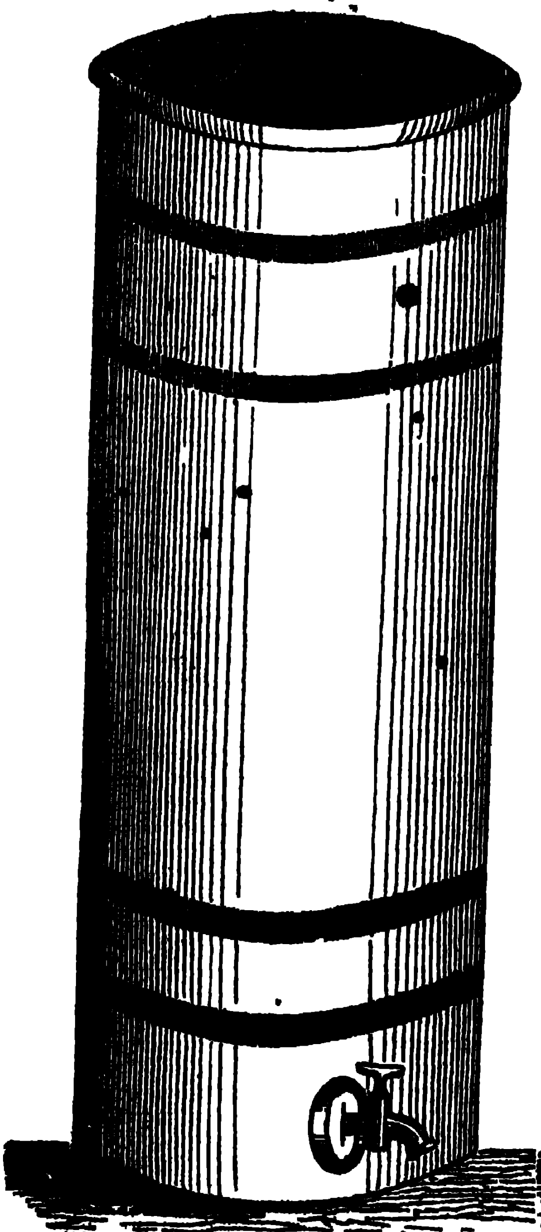
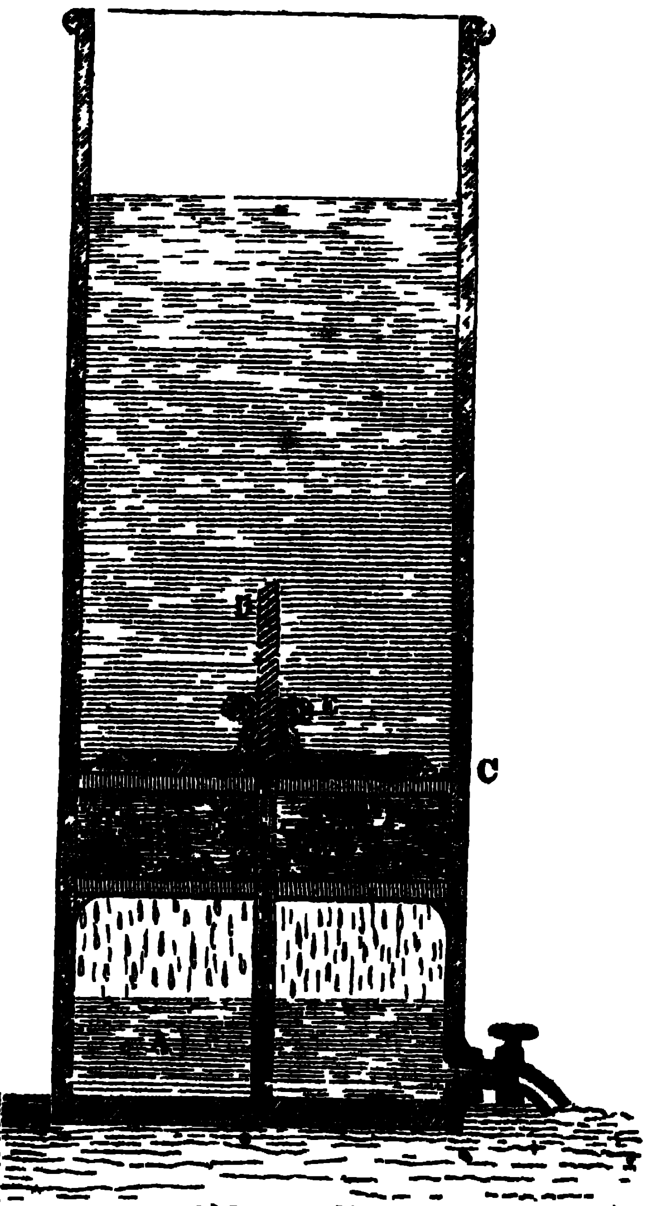


Fig. 2.



## MAY'S RAPID FILTER.

[From a Correspondent.]

It is highly important to the health of families, that water intended for their daily consumption should be free from all impurities.

Good and clear water is also a valuable acquisition to such manufacturers as paper makers, dyers, bleachers, and calico printers; and in order that families and manufacturers should have a constant and copious supply of pure water, filtration, on a large scale, is necessary.

The systems of filtration already used by the public, furnish filtered water in such trifling quantities as to be of service only to small families, in addition to which, great inconvenience is experienced by the filters being constantly out of repair, and from their having to be taken away to be put to rights; while manufacturers like the paper maker, dyer, bleacher, calico printer, &c., who require such large quantities of filtered water as 120,000 gallons per day, are without any system of filtration whereby they can obtain pure water in such large quantities.

Again, the vinegar distiller, oil merchant, and sugar refiner, are without any rapid system of filtration by which they can clarify their liquids; but by the method now to be explained, oils, vinegar, and sugar juice, are clarified in the most perfect manner, and at a very rapid rate.

Fig. 1 of the accompanying engravings is an external representation of a patent rapid filter, called No. 1, which is eight inches in diameter, and twenty inches high, and capable of filtering upwards of 100 gallons of water, or other similar liquid per day of 24 hours.

Fig. 2. Is a section of the same; A, the false bottom or well into which the filtered liquid is received, covered with a perforated plate, above which there is a layer of horsehair or serge; B is the filtering medium, which consists of prepared cotton divested of every particle of dirt and grease; C is an iron or earthenware plate pierced with fine holes, or covered with wire gauze. A galvanized iron rod D, passes from beneath the bottom of the filter, through the filtering materials, and terminates in a screw at its upper end.

In preparing this filter, the cotton being already thoroughly cleansed, is soaked in clean water, and then packed or kneaded into the filter, taking care to press it well against the sides of the containing vessel; the plate C is then placed upon the cotton, and above it a circular iron frame. The nut E is then screwed upon the upright rod until the filtering medium is sufficiently compressed.

In the construction of large filters for the supply of paper makers, dyers, calico printers, &c., requiring as many as 10,000 gallons of water per hour, the arrangement is slightly varied. In this case the rod D is dispensed with; the cotton is packed or kneaded on to the covering of the false bottom, the full size of the tank or reservoir, and pressed down by an iron frame-work covered with wire gauze. A screw and lever are employed in the first instance to give the required pressure, when iron rods, fitted with set screws, are slid down metal grooves placed two on each side of the vessel, which retain the parts in their proper position when the screw is removed.

The patentee claims the following advantages for his system of filtration; viz.,

1. That water may be filtered to any extent.

2. That wines, oils, vinegar, sugar juice, cider, and all liquids, may be filtered without injuring their quality, taste, or colour.

3. That the size of the filters are small, in comparison with the large supply of filtered water. For example; a filter of eight inches in diameter, by twenty inches high, will filter water at the rate of 1500 gallons per day.

4. That filters can be easily cleaned, and upon the premises where they may be situated.

5. That the water is not made hard by filtration, the filtering medium being quite free from chemical preparation, which is worthy the attention of dyers, bleachers, calico printers, colour makers, &c., who require pure water without being made hard by filtration.

The advantages that strike us as being most important, are the rapidity of its action, and the facility of cleansing, which latter can at any time be effected in a few minutes, either by

washing the cotton, or by putting in a fresh supply.

With respect to the rapidity of operation, one which we inspected at the depôt in Chatham-place, not above 2 ft. in diameter, was filtering at the rate of 7000 gallons a day.

Where reservoirs, tanks, or backwaters are on the premises of large establishments, filtered water can be had to any extent, as it is only necessary to place one or more of these filters in communication with the supply of water, and the filtered water can be drawn off as fast as it may be required.

Families, hotel keepers, and tavern keepers, can have the filters fitted to their house cisterns, by which means filtered water can be had to any extent, for culinary and laundry purposes, as well as for the service of the bed chambers and bath rooms.

## IMPROVEMENTS IN PIANO-FORTES.

Sir,—In fulfilment of the implied promise contained in my last, I take the opportunity of my earliest leisure to return to the subject of improvements in piano-fortes.

Amongst the causes of the varieties in these instruments, perhaps none is so apt to affect the quality and power of their tones, as the differences in the construction of the sounding board, and as, with few exceptions, the makers of them appear to have no fixed rules for the construction of this, certainly most important part of the instrument, it may not be undesirable, if, previously to suggesting alteration, we consider, in the first instance, what purposes it is designed to fulfil; and secondly, what conditions are most favourable to its performing them; for it is only by such a process of reasoning we may hope to attain that knowledge, by which improvement in the works of art may be effected.

It has been correctly said by Professor Robison that the function of the tube in wind-instruments, is, by its length to determine the number of aërial pulsations in a given interval of time, but that the sound is due to the air in motion within the tube, not to the pipe in which it moves. In piano-fortes, a similar effect is produced by the string, that is, the string determines the number of vibrations, or pitch of the sound, but can hardly be said to produce sound itself, as may be shown, by causing a string to vibrate when stretched over a stiff bar of metal, or any other substance which is incapable of acting as a sounding board, when little or no tone will be perceived. From this fact, it is plain the cause of sound in stringed instruments must be sought, not so much in their strings as in their sounding-boards; a larger or smaller string will, no doubt, considerably influence the quality and power of the tone, and it does so, probably, by causing more or less powerful vibrations of the sounding-board,—the vibrations of the larger string being a more powerful moving force, for it is almost wholly by the vibration of this part of the instrument, causing corresponding aërial vibrations in the surrounding atmosphere, that the audible sound is produced.

From a consideration of the mode by which a sounding-board is put into a state of vibration, viz., by the vibrations of the elastic string being communicated to it by the bridge, to which both itself and the string are attached, it may be reasonably inferred, that the tone of the instrument will be more powerful and continuous, in proportion to the *freedom* with which the sounding-board is capable of vibrating, and that its vibrations will be free, in proportion to its lightness, elasticity, and the absence of all *pressure* or load on it. Now if this inference is not incorrect, I fear the practice of the makers of piano-fortes is very much at variance with reason, for the sounding-board, besides being stiffly barred, which is perhaps needful at the treble part, is commonly loaded with a very considerable downward force, resultant from the deflection of the strings from a line parallel to itself, and is moreover subjected to a side strain of no small amount, by the lateral deflection of the wire between the two pins of the belly bridge, which latter force would cause the bridge to describe part of a revolution, were it not firmly attached to the belly, which is, of course, necessarily made strong enough to bear these, *certainly unnecessary* forces. I need hardly add, to be sufficiently strong, it must be either heavy enough, or stiff enough, and in either case is *less* capable of vibration, than if it were lighter, less stiff, and not subjected to such forces as must resist its motion.

As pointing out defects without suggesting remedies is, if not an useless, at least a most ungracious task, I will take the liberty, with all due deference to the numerous "practical men" among your readers, of suggesting, that to obtain the required increase of vibration, the bellies be made considerably larger, and not so stiff, particularly that part *beyond* the bridge, in the tenor and bass compass; indeed I know no good reason why upright instruments should not have bellies nearly the whole size of the interior of their cases. In the upright instruments constructed in this manner by my esteemed friend, John Isaac Hawkins, Esq., the bellies of which were not "barred off," there was very considerable increase in their vibration, and consequently in the power of the tone; indeed, the desirableness of this may be rendered probable by the construction of instruments of the violin kind, which, when made for the lower part of the compass of musical sounds, have a very large belly, but piano-fortes, and in particular "grands," have hitherto been generally made with that part of the belly beneath the bass bridge, much smaller in proportion than the tenor part.

Before terminating my observations on the subject of sounding-boards, I may remark, it is a question yet undecided among makers, which is the best direction for the grain of the wood of which they are formed, and very fine instruments have been constructed, in which it has varied from parallelism to 90°, with the strings; perhaps the balance of advantages is in favour of the grain being at right-angles, and bellies so constructed only require to be attached to the case of the instrument, at the ends of the grain, which leaves them more free to vibrate. For this improvement, with many others, we are also indebted to Mr. Hawkins, who introduced it into the piano-fortes constructed by him thirty years ago, and that it is an improvement we may be warranted in concluding, from its having been adopted by Messrs. Broadwoods, in the best grand piano-fortes which they have lately produced.

To relieve the sounding-board from the destructive downward pressure, the strings should be parallel to it throughout their whole length, up to the wrest-plank bridge; and to insure sufficient connexion between the strings and the bridge, I would recommend the employment of *three* pins instead of two, inclined at an angle of say 40° to 50° with the plane of the sounding board, and so placed as to produce a *very slight lateral* deflection of the string. Very little indeed is requisite when three pins are employed, which besides decreasing the danger of breaking the wire, suffers the strings to be more equally stretched throughout their *whole* length, causing them to "come up" sooner, and stand in tune better. Three pins have also the great advantage of completely compensating the lateral force of the strings, for it will be obvious to your mechanical readers, that if the strings press with a given force against each of the two outer pins, they must press with a force equal to the sum of those forces, against the centre pins in the opposite direction.

In my next communication I design to advert to the subject of the different modes of bracing piano-fortes, and the arrangements of the moving parts technically termed the action, and may also add a few observations on the proportionate lengths and thickness of the strings or scale, should you, Mr. Editor, consider this offering acceptable.

I remain, yours respectfully,

ALFRED SAVAGE.

16, Garlic Hill.

## PILBROW'S CONDENSING CYLINDER STEAM ENGINE.

Sir,—Unwilling to occupy too much of your valuable columns, (though I still maintain that any more important improvement in the steam engine has never appeared in your pages for *investigation,*) I beg to refer Lowemnaphretts to the letter of W. M. in a late Number, and to my reply thereto in No. 943. He will find there, answers to all his objections if he read both attentively. He will see too, that the superior advantages of my engine were doubted, through a misconception of W. M., who thought it could not be better than the present engine, because he supposed the used steam would flow, as it does there, *into a space*, and be subject, therefore, to the same conditions, namely, the difference between the cylinder and condenser vacua. But Lowemnaphretts says my engine must be worse than the present, because it has *no space* for the used steam to flow

into! I have already pointed out both these errors, and will merely observe on the last, that if my condenser piston could not move (as Lowemnaphretts says) because there is no space for the steam to flow into, no more could the piston of the present engine move. The steam from the boiler finds no space there, but soon makes it even with a plenum (nearly) on the other side to start against; so does it make a space in the condensing cylinder of my engine, with this superior advantage, that an almost perfect vacuum has *already been formed on the other side during the previous stroke.* In the former case, the steam has to contend, and make a space against a resistance, almost equal to itself, for the instant, though it suddenly diminishes. In the latter, the steam has no uncondensed steam to contend against, but *commences* with a *better* vacuum than is *now* obtained at the *end* of the stroke.

Lowemnaphretts has not, I think, sufficiently considered the principle of the condensing cylinder engine. There appears, in his paper, a misapprehension of the mechanical force or effect produced by two pistons in two separate cylinders, having a communication between them, with a plenum at one extremity, and a nearly perfect vacuum at the other. Lowemnaphretts must have lost sight of the fact, that whatever is between the two pistons under these conditions, matters not at all, so long as the passage between them remains open. The effect upon the pistons, owing to the equilibrium, will be precisely the same as if the engine had but one piston and cylinder, with a plenum on one side, and a nearly perfect vacuum on the other.

Nor has Lowemnaphretts better considered his objection, that my engine requires what the present does "to get the full maximum effect," namely, "that the passage between the cylinder and condenser must be opened before the termination of each up and down stroke." To prevent this was my object, and which I succeeded in, because each available vacuum is made, as before observed, during the previous stroke, and therefore is there no reason for the eduction valve to be opened before the termination of each stroke. *Essentially, in these important points, my engine differs from all others, enabling me to get the full effect of both steam and vacuum,* the first of which is by the present practice, in an appreciable degree sacrificed, to get a better, though still a very inferior vacuum.

As the rest of his paper is founded on his previous erroneous views, I need not further occupy your Journal, but hope he will again object to my engine, if not fully convinced on any point.

I am, Sir, yours respectfully,

James Pilbrow.

Tottenham Green, August 10, 1841.

### CORNISH WATER-WORKS ENGINE.

Sir,— Having seen in your Journal an assertion by Mr. Pilbrow, that the engines on the Cornish plan erected at Old Ford, and at Battersea waterworks, are doing as much duty as those used for mine-pumping in Cornwall, I am induced to make a few remarks. If I understand rightly, the waterworks' Cornish engines throw away a great deal of their power in raising a cast iron plunger, the weight of which is obliged to be equal to the maximum pressure of the water in the mains; as the weight of this plunger, and *not* the immediate force of the steam, is applied to press the water, as is the case in the pumping engines in London, made by Messrs. Boulton and Watt. These engines work slightly expansively, and there is an apparatus attached to them which regulates the steam-valve, which is the expansion valve also, so that the steam is worked more expansively for low services or pressure in the main, than for high services, by which means much economy is effected. I believe something of this kind was attempted at the engine before mentioned at Battersea, but it failed to act with the Cornish system, and the consequence is, that there is now a rising main fixed, so that the engine always pumps the whole of the water to the maximum height, whether it is required or not; in fact it pumps more than half its time water up hill to let it run down again. I believe the engine at Old Ford is in the same predicament; if so, I fear the advantages of Cornish engines for water-works has been very much overrated. It would be a curious and valuable experiment, to try one of Boulton

and Watt's pumping engines with a *Cornish proportion of surface of boiler* together with a slow combustion, and with all the pipes and surfaces usually exposed by them to the cooling influence of the atmosphere, covered, in fact clothed up like a Cornish engine, and with steam of 5lbs. or 6lbs., cut off to suit the low services, and varied as the services got higher, by the apparatus before mentioned, and to note the results. I am inclined to think they would be very close on the Cornish engine, circumstanced as it is as a water-works engine. I am not going to say that there is no advantage in the Cornish engine; I believe no engine is at all equal to it as a mine engine, and this is owing to its always having the same lift, and the plunger or counter weight proportioned to it. Perhaps some of your correspondents can inform me whether the results given of the duty of the engine at Old Ford are for water *usefully* raised, or for water lifted, say 100 feet, when frequently for long intervals 50 feet would be sufficient. Hoping you will, without inconvenience, soon find a corner in your truly valuable Magazine for these observations,

I remain, Sir,

Your obedient servant,

INQUIRER.

London, September 7, 1841.

### THE CALCULATOR—NO. XII.—MENSURATION.

*New Rule for the Content of a Rectangular Prismoid,* a figure of which, practical instances occur in earth mounds, and cuttings, reservoirs, corn and hay stacks, &c.

*Rule.* — Arrange the two lengths side by side, and the two breadths under them, thus: $\begin{matrix} L & l \\ B & b. \end{matrix}$ Multiply the quantities diagonally ($L\,b$ and $B\,l$) and take half their sum. To this add the separate products of the quantities taken vertically ($L\,B$ and $l\,b$). Multiply the total by the height, and divide by 3.

*Obs.*—If either the height or the sum of the three products be divided by 3, it should be done before the last multiplication is made.

The above rule arises from a simple transformation of the formula usually given. Its advantage is, that it is much more easily impressed on the memory than either of those given by Hutton or Keith.

When the slope is uniform, *i. e*, when the horizontal extension is equal on all sides, as is very frequently the case; it may be preferable to use the following rule; especially if the extension be small in proportion to the length and breadth:—

*Rule* 2.—Multiply together the arithmetical mean length and breadth, add thereto $\frac{1}{3}$ of the square of the horizontal extension, and multiply the whole by the perpendicular height.

Possibly unskilful persons may sometimes imagine that it is sufficient to multiply together the mean length, breadth and height to obtain the content. The last rule shows that the result so obtained must be defective by a quantity equal to $\frac{1}{3}$ of the square of the extension, multiplied into the height.

J. W. WOOLLGAR.

Lewes, September 6, 1841.

### ON BURNING SMALL COAL IN COMMON GRATES.

Sir,—The question broached by Mr. Shackleton at page 91 of your 938th Number, as to the best mode of burning small coal or *slack*, is one of considerable importance in domestic economy, and one that is frequently put, but seldom satisfactorily answered.

Mr. Shackleton's proposition to place air tubes in the fire, although ingenious and philosophical, is not practicable. The practice of wetting the *slack*, and laying a thick coat on the top of the fire, is decidedly bad; nor is its admixture with clay much better.

I have found the best method of using small coal to be, to wet it, either alone, or mixed with cinders (freed from ashes by sifting). When this fuel is to be added to a fire, the live coal, &c., is to be drawn forward against the front bars, by inserting the poker at the back of the grate, and filling up the vacuity thus formed with the slack. A species of coking immediately commences, the gases pass into the fire and are consumed, and in a short time the small coal becomes an agglomerated

mass, which may be brought forward to make room for the next charge of coal dust. By this simple process, a troublesome commodity may be turned to good account, without producing much smoke, or incurring much loss.

The great quantity of small coal that now finds its way into our cellars, among what is sold as "screened coals," makes this question one that greatly affects our comforts, and altogether an affair of vital import to the breeches pocket.

I am, Sir, yours respectfully,

WM. BADDELEY.

August 27, 1841.

## INVESTIGATION OF THE POWER OF THE PADDLE WHEEL.

Sir,—The all but universal adoption of the common paddle-wheel for the propulsion of steam boats, and the advocacy of your talented correspondent, Mr. Holbrooke, some time since in the *Mech. Mag.*, have made me hesitate about stating my views of the great waste of power incurred; but as your journal is always open for the discussion of mechanical truth and the correction of error, I trust you will give me an early opportunity of stating a few facts, which, if the calculations I have made are correct, show any thing but favourable results from the paddle-wheel; if they are not correct, I shall be glad to be set right.

To leave as little room as possible for cavil, I shall take my data from the account of the cruise of the *Medea* steam frigate in the Mediterranean, in the years 1834—5 and 6, as published in the last edition of "Tredgold's Steam Engine."

The engine is 220-horse power.

| | ft. | in. | |
|---|---|---|---|
| Paddle-wheel (Morgan's) .. | 24 | 6 | diam. |
| Length of paddle board.... | 5 | $7\frac{1}{4}$ | |
| Depth of ditto........ | 3 | 4 | |
| Number of paddle boards........ | | 11 | |
| Maximum number of revolutions.. | | 22 | |

| | | |
|---|---|---|
| Speed, with full load of coals and stores | $8\frac{3}{4}$ | nautical miles per hour. |
| Ditto half ditto .. | $9\frac{1}{2}$ | ditto. |
| Ditto light ditto .. | 10 | ditto. |
| Ditto under canvass, close hauled .... .. | $8\frac{1}{2}$ | ditto. |
| Ditto ditto on the quarter .... | $11\frac{1}{2}$ | ditto. |

Total canvass, as measured from the engraving of the *Medea*, 12 sails, 2164 square yards.

The paddle-wheel being suspended at the centre, and the machinery keeping it, always, when in the water, nearly vertical, the acting centre will be about the middle of the paddle board, making the acting diameter of the wheel $\overset{\text{ft. in.}}{24\cdot6} - \overset{\text{ft. in.}}{3\cdot4} = \overset{\text{ft. in.}}{21\cdot2}$.

In finding the free power expended in the propulsion of a steam-boat by any paddle-wheel, it is undeniable, that the utmost useful resistance can be no more than what would be produced from a stream of water striking an undershot water-wheel, when the water moved at the same velocity with which the paddle-wheel strikes the water, and that velocity can be no more than the difference of the paddle-wheel and the boat through the water.

Now the power in lbs. per square foot, is found by squaring the velocity of the paddle in feet per second, and deducting $\frac{1}{40}$th from the amount.

The paddle-wheel moving at a maximum of 22 revolutions per minute, and the acting diameter being $\overset{\text{ft. in.}}{21.2}$, this will give $\frac{\overset{\text{ft.}}{21\cdot2} \times 3\cdot14 \times 22}{60} = \overset{\text{ft.}}{24\cdot4}$ velocity of the paddle board per second.

And as the velocity of the boat at best speed was 10 nautical miles per hour of 6075·6 feet each, this gives the velocity of the boat at best speed 16·87 feet per second, which, deducted from 24·4 feet, gives the velocity of the paddle through the water 7·53 feet.

Then $7\cdot53 \times 7\cdot53$ less $\frac{1}{40}$th is 55·3 lb. as the resistance on each square foot of paddle board.

There being two boards of each, which are always immersed in the water, or four with both wheels, each $\overset{\text{ft. in.}}{5\cdot7\frac{1}{4}} \times \overset{\text{ft. in.}}{3\cdot4}$ will be $4 \times \overset{\text{ft. in.}}{5\cdot7\frac{1}{4}} \times 3\cdot4 = \overset{\text{ft.}}{75}$ feet of board always acting; therefore,

$$\frac{\overset{\text{ft.}}{75} \times \overset{\text{lb.}}{53\cdot3} \times 7\cdot53}{33\cdot000} \; \frac{60}{} = 56\,\frac{25}{33} \text{ horses}$$

power, little more than $\frac{1}{4}$th of the 220 horses power of the steam engine.

What becomes of the other $\frac{4}{5}$ths of the power? I must leave those who use and advocate the common paddle-wheel to account for this. So far as I can see, no more of the power is expended in propelling the vessel, whatever else becomes of it.

But does not the action of the wind bear out this calculation? Tredgold says 32 yards of canvass are equal to 1 horse power, and as the utmost amount of canvass measured very carefully from the plate of the *Medea* is 2164 square yards, this gives 67 horses power as the whole force of the canvass, while the speed is stated to be $11\frac{1}{4}$ miles the hour.

In stating this case against the paddle wheel, I have taken the best and fairest case I could find, and have selected that view of it which made the best for the paddle-wheel, and it would be out of place now, saying any thing about the disadvantage of the paddle in a rough sea or against a head wind—my object being merely an inquiry how much real power does the paddle-wheel, under the best circumstances, give out for propelling a boat.

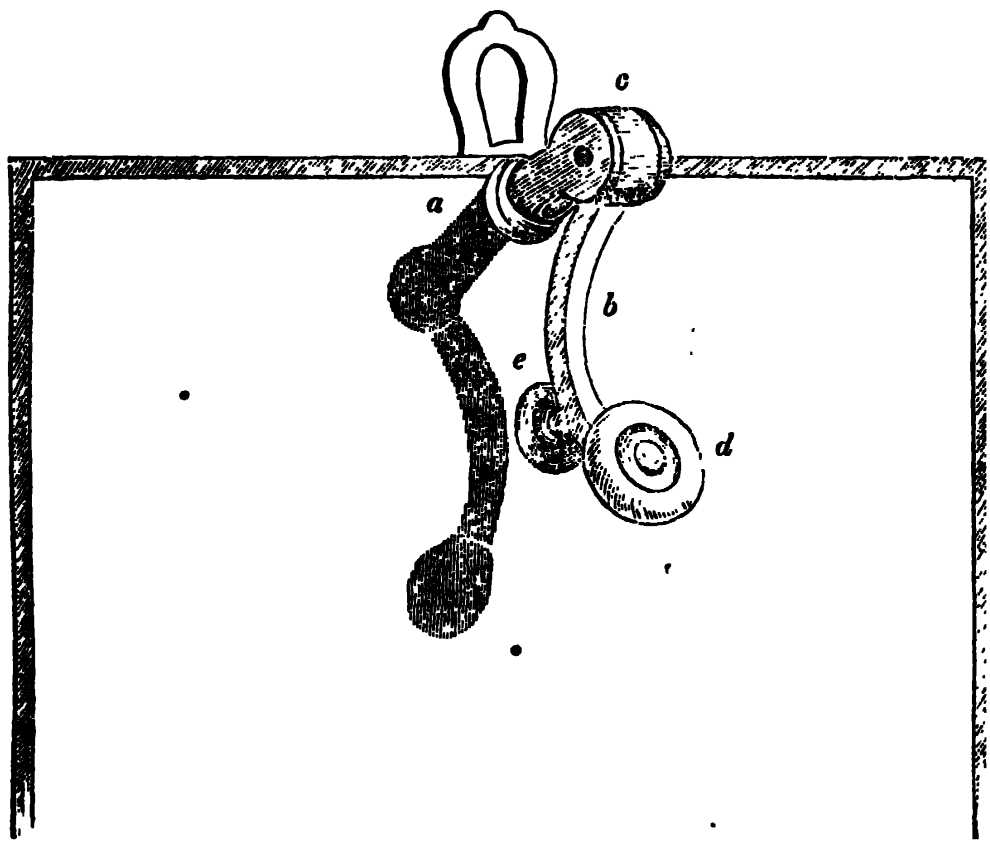
I am, Sir, yours, &c.

TIMOTHY BURSTALL.

St. Martins Lane, Sept. 11, 1841.

## HEELEY'S SELF-ACTING SPRING LETTER CLIP.

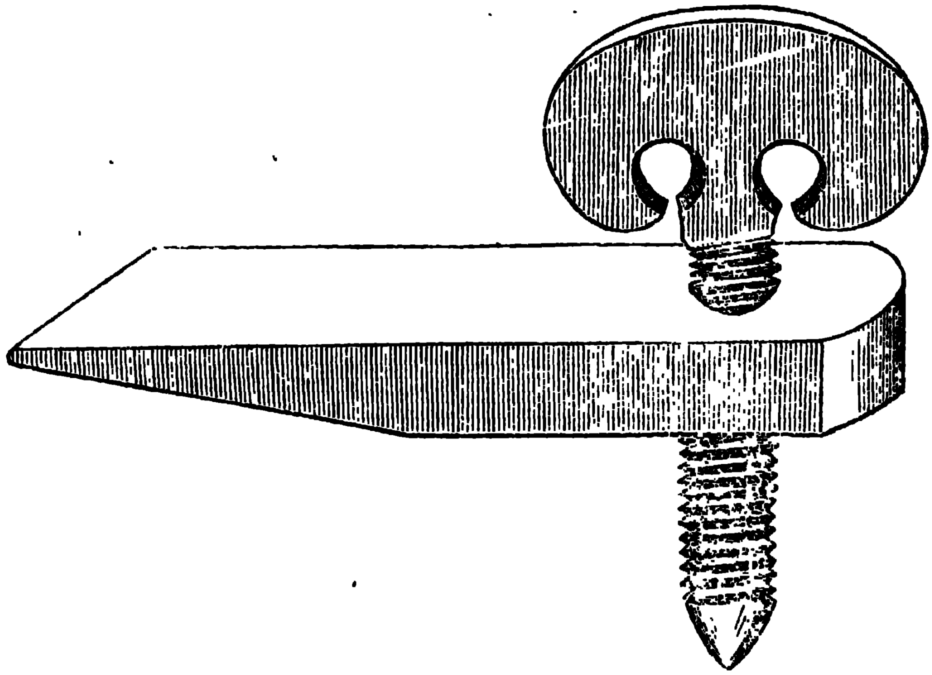
(Registered pursuant to Act of Parliament.)




The above engraving represents a most ingenious contrivance for keeping together letters and papers of all descriptions, in due order, and in readiness for immediate reference. It consists of a brass limb *a*, affixed to a suitable board, and to this limb, a second one, *b*, is jointed, a curvilinear spring being situated within the joint at *c*, somewhat resembling a snuffer spring, but much stronger; the latter limb terminates in a neat ivory knob, *d*. On the under side of the lower limb *b*, a brass boss, or button *e*, is affixed by a pin joint, so as always to press in a line parallel with the surface of the board, whether the papers embraced are few or many. To insert a letter, it is merely necessary to lift the knob *b*, put the letter in position, and then release the knob, when the spring immediately forces the button *e* down upon the papers, and holds them until they are again intentionally released.

Letters and documents may thus be almost instantaneously secured in due order, without being torn or mutilated, and Mr. Heeley's ingenious spring letter clip takes precedence of all the numerous contrivances for a similar purpose with which we are acquainted. They are neatly got up, and sold at a very moderate price.

## TRAVELLERS' PROTECTOR.



Dear Sir,—I herewith send you a description of a very simple contrivance for securing doors, which may be found a useful companion both to travellers, and to residents at home.

All doors (the exception being extremely rare) are so constructed, that they must be opened from without, inwards, into the apartments to which they belong. It is to such doors only that my fastening is applicable. It will be seen that it consists of a peculiarly-formed wedge, having a thumb screw penetrating through its substance at the base. The wedge is chisel-shaped. It is formed of steel, and has its thinner extremity hardened, and then reduced to a spring temper. The screw is also of steel, obtusely pointed at its end, and hardened and tempered at its point only. Its application is as follows:—

1st. Close the door of the room in which you desire to remain secure.

2nd. Insert the wedge under that stile of the door to which the ordinary fastening, or latch, is attached, but do not push it, until the edge has passed to the extent of the entire thickness of the door. In doing this, *keep the straight side of the wedge uppermost.*

3rd. Turn the thumb-screw, so as to force the wedge upwards, until a moderate resistance is perceived. The door cannot now be opened unless the hinges are torn away.

The peculiarity of this fastening is: —its simplicity of construction—the facility of its appliance—the power it affords of jambing a door, if required, firmly against the upper portion of its frame—the impossibility of its slipping backwards (as an ordinary wedge may) —the certainty that the more the door is forced inwards, the more securely the fastening will become impacted—the great readiness with which it may be removed by the party using it—the absence of unsightly marks from its use —the total impossibility of its being removed externally without such a continued noise, as could not fail to awaken, or alarm its proprietor,—and finally,

its extreme portability, even to its admission as an implement for the dressing case.

This contrivance is available, even upon a *stone floor*; and if made on a larger scale, it might afford an efficient security for the external doors of houses,—particularly if a plate of iron were so fastened upon the interior of the door, that the portion of the door itself, under which the wedge should be placed, could not be sawed out.

I enclose a drawing of this "Travellers' Protector," the scale being precisely similar to that which I carry in my own travelling "omnium gatherum." Length of the wedge 3¼ inches, width ⅞ inch, thickness ⅜ inch (barely), length of the screw 1¾ inches, diameter ⅜ inch.

Believe me very faithfully yours,

CHAS. THORNTON COATHUPE.

Wraxall, September, 9, 1841.

### STEAM PRESSURE OF THE THAMES STEAMERS.

Sir,—When I took the liberty of addressing a simple question to your correspondent, "Nauticus," (No. 938, page 89,) I requested a "candid answer." A tardy answer has at length been vouchsafed, but it is the very reverse of candid—indeed any thing more shuffling and evasive could hardly have been penned.

Instead of giving the information I required—which was simply the pressure under which some of the new steamers were worked — "Nauticus" sets out by stating—not that he does not possess the information, but that— "he cannot give it."

Indeed he seems mighty angry that such a question should be raised, and talks very large about "imputations, unfair means, unworthy sources, preposterous stories," &c., and scorns the idea of our London engineers resorting to the unfair means used by a Clyde engineer of unfortunate notoriety, in order to obtain great speed; and yet, in the very same paragraph, he admits that he has every reason to believe, that the pressure now used in the Thames boats, is *not more,* if so much, as that used on the Clyde! So that, although the practice of the Clyde engineer is affected to be held in such utter abhorrence, the engineers of our Thames steamers have taken a leaf out of his book at last! However "preposterous" my stories might have appeared, they are now fully confirmed by "Nauticus." With respect to the rupture of the *Brunswick's* boilers, I was unfortunate in the choice of an expression; but "Nauticus" has set me right; it was "a defective steam pipe gave way." All things are defective when they give way, but *will* "Nauticus" state (for he *can*) the pressure under which said steam pipe "gave way?" This is all I asked for.

There may be no real danger in the increased pressure now employed in the new steamers, but I do not like so much secrecy and concealment about the pressure actually employed, especially by those who have hitherto boasted of being all fair and above board.

I am, Sir, your obedient servant,

RUFUS.

Whitechapel, Sept. 13, 1841.

### AIRE AND CALDER NAVIGATION.

Sir,—I send you herewith a series of questions which were put to me with a view to elicit evidence to be given in a case before Parliament, last session, with my answers to them, which, if you think worthy of a place in your valuable Magazine, you are at liberty to publish.

I remain, Sir,

Your very obedient servant,

WILLIAM BULL.

Wakefield, July 20, 1841.

*Q.* Are the Aire and Calder, and the Calder and Hebble made navigable by means of locks and weirs; and how many years may it have been done?

*A.* Both of these navigations were originally formed by partly damming up the rivers with new weirs at certain places, and partly by making use of existing mill-weirs, with short side-cuts, or canals and locks, to pass the respective weirs. The first act for the Aire and Calder Navigation was obtained in 1699, and the first for the Calder and Hebble in 1758; but in consequence of a flood having destroyed the works, (which had been executed for a part of the line only,) in 1767, this act was repealed in 1769, and a new one obtained, soon after which the whole line was executed. Both Navigation Companies have obtained several subsequent acts for the improvement of their navigations.

Since the navigations were first constructed, the respective companies have been gradually improving them, by substituting side cuts, or canals, for the river-ponds, more particularly within the last few years.

In 1820, the Aire and Calder company obtained an act to make a new canal from Nottingley to Goole, a distance of about seventeen miles, to avoid the inconvenience arising from navigating in the rivers, and to communicate with the tideway at a point considerably nearer to the sea, so as to bring in vessels of larger dimensions to the docks built at the latter place: this canal was ultimately extended up to Ferry Bridge, a mile further, and was opened in 1826.

Vessels passing down this canal avoid about 4½ miles out of the 19 miles now navigated, when going by way of Selby, and about 14 miles of the worst part of the tidal river Ouse.

In 1828, they obtained an act to further improve their navigation by making new cuts and canals between Leeds, on the Aire, and Wakefield, on the Calder, and Ferrybridge, under which act they have constructed extensive lines of canal, avoiding the greater part of the river navigation. One of the most important of these cuts or canals, which extends to within about a mile of Wakefield, was completed about twelve months since, by which they avoid a circuitous river course, much subject to floods, and save several miles of distance; and in that part of the navigation which lies between Wakefield and the last-mentioned canal, where the river is still used, they have within the last few months spent several thousand pounds in removing the shoals of the river.

The Calder and Hebble Navigation Company have in like manner proceeded gradually, for upwards of forty years, to improve their navigation by substituting canals for the river, principally with a view to avoid the inconvenience arising from shoals and floods, and partly to obviate disputes with mill-owners, arising from the weirs of the Navigation Company causing (by penning up the flood waters) the mills to be more frequently thrown into back water than they had previously been; and, from the same circumstance, both the companies have been compelled to purchase several of the mills on their respective lines.

The first great improvement made by the Calder and Hebble Company, by substituting canals for river navigation, was that of making a canal, of about two miles in length, near Dewsbury, about the year 1798; from that time till about the year 1825, they substituted canals for the river in various parts, so that the extent of river navigation was then reduced to about 7½ miles. Soon after I took the management of their works, in 1833, I projected a further improvement, by substituting canals for the remainder of the river navigation; and in the following year they went to Parliament for power to execute part of the said canals, since which they have constructed about 3¼ miles of the new canals, which was completed about two years since, and by which they avoid about 2½ miles of the river.

*On the Aire and Calder Navigation.*

Q. How many locks and weirs are there?

A. From Leeds to Selby there were eleven locks, but now only ten locks, and there were eleven weirs, but now there are only ten, eight of which were existing mill-weirs, and the rest were erected for the use of the navigation. From Wakefield to where the Calder joins the Aire there are four locks, and there were four weirs, one of which has recently been removed, in consequence of an aqueduct having been built over the river near to it: one of these weirs is an original mill-weir, the others for the navigation. Of the above weirs, seven are now abandoned, so far as the main lines of navigation are concerned.

*On the Calder and Hebble Navigation.*

From Sowerby Bridge to where it joins the Aire and Calder navigation, there are twenty-eight locks, and there were sixteen weirs, forming so many river ponds of the navigation, two of which have been taken down, and five have been abandoned, so far as the main line of the navigation is concerned, and are now only partially used for local purposes: of the above sixteen weirs, seven were original mill-weirs, and nine built for the use of the navigation.

Q. The length so made navigable, and what fall?

| | |
|---|---|
| A. The length of the Aire and Calder, from Leeds to Selby, was about ...... .................... | 30½ miles |
| From Wakefield to where the Calder joins the Aire, near Castleford, about ................. | 12½ |
| Total length of the Aire and Calder ....... ........... . ...... | 43 |

N.B.—The above navigation is much shortened by the substitution of canals for the rivers, which (particularly between Wakefield and Castleford) are very circuitous.

The Aire and Calder Company now use about nineteen miles only, of the rivers for their main lines; the rest is entirely abandoned, or only used for local purposes.

The fall from Wakefield to the junction of the Aire and Calder

| | |
|---|---|
| Brought forward........ | 43 |
| rivers is 28 feet 3 inches; from Leeds to the same place, 43 feet 9 inches; and from the junction to the tidal river at Selby, about 34 feet 6 inches. | |
| The length of the Calder and Hebble was about ................ | 22 |
| which has been lessened by the substitution of canals for the river navigation, about two miles. | |
| The Calder and Hebble Company now use about 4¾ miles, only, of the river for their main line, the rest has been entirely abandoned, or is only partially used for local purposes. | |
| The fall from Sowerby Bridge to Wakefield is 184 feet. | |
| The total fall from Sowerby Bridge to Selby is 242 feet 9 inches, by 35 locks. | |
| Total........... | 65 miles. |

*Q.* Are the weirs oblique to the river, or sectional?

*A.* All the weirs built for the use of the navigations are at right angles with the stream, or nearly so, but some of the mill-weirs are rather oblique to it.

*Q.* About what length are the weirs?

*A.* The weirs vary from about 300 feet to about 100 feet in length, the longest being generally towards the lower ends, and the shortest towards the upper ends of the river; but this is not an invariable rule, as some long ones are situated high up.

*Q.* And how wide the river above the weirs?

*A.* The rivers are generally rather narrower above the weirs than at them.

*Q.* Are the locks in the river at the weirs, or in side cuts?

*A.* All the locks are in side cuts where the passage from one river pond or level to another is made by short cuts, but many of them are on canals of several miles in length.

*Q.* Are any shoals passed by side cuts, without weirs?

*A.* There are no shoals passed by side cuts, without weirs.

*Q.* Are there any shoals dredged? and to what extent?

*A.* There are shoals in most of the river ponds, on both the navigations, which require frequent dredging: the Aire and Calder have two dredging-boats, and the Calder and Hebble have two dredging-boats, which, till very recently, were almost constantly employed in removing shoals, more particularly after floods, which in these rivers are of frequent occurrence, and bring down considerable quantities of sand and gravel.

*Q.* Has the erection of locks and weirs produced much increase of floods?

*A.* In my answer to the last question I have stated that floods are of frequent occurrence, and it follows as a matter of course, that the erection of weirs must raise the head of water in proportion to their height; the consequence is, that in moderate or ordinary floods on the Calder, between Sowerby Bridge and Wakefield, the weirs cause the water to rise above the level of the land in the valley oftener than it would do if no weirs existed. There are, however, about, on an average, from three to four floods in a year, which rise considerably above the level of the valley, and overflow the adjacent lands, which would do so, though perhaps not quite to the same extent, if no weirs existed; therefore the greatest evil to the adjacent lands arising from the erection of weirs occurs when the floods are of that extent, which would be retained within the ordinary banks of the rivers if no weirs existed, and there, as I have before shown, are the most frequent.

The fall of the valley from Sowerby Bridge to Wakefield is rapid, being at the rate of about 8⅓ feet per mile, on an average; consequently the water does not remain long on the land, after it gets out of the ordinary channel: but below Wakefield, and on the Aire, from Leeds, and particularly after the Aire and Calder have united near Castleford, the valley is much flatter, and the water, after it has got out of the ordinary channel, remains on the land for a considerable time, and there the erection of weirs is attended with much more disadvantage than in the upper part of the valley of the Calder.

Great part of the lands adjoining both rivers are, however, artificially embanked, which partially protects them from the floods; but it is only in a few instances that the embankments are sufficient to effectually secure them from the ordinary floods, and in still fewer from the great annual floods.

WILLIAM BULL.

Wakefield, April 16, 1811.

## HISTORICAL ACCOUNT OF WOOD SHEATHING FOR SHIPS. BY MR. J. J. WILKINSON.

This communication commences with the earliest history of naval architecture, the different modes of construction, and the precautions taken for the preservation of the vessels from the attacks of marine animals.

A very early instance of extraordinary attention to the preservation of the bottom of a vessel appeared in a galley supposed to

have belonged to the Emperor Trajan, A. D. 98, to A. D. 117, which was found in the fifteenth century in the lake Nemorese, (or Lago Riccio,) in the kingdom of Naples, and was weighed after it had probably remained more than 1300 years under water; it was doubly planked with pine and cypress, coated with pitch, upon which there was a covering of linen, and, over all, a sheathing of lead fastened with nails of brass or copper; the timber was in a perfectly sound state.

In the reign of Henry VIII, large vessels had a coating of loose animal hair attached with pitch, over which a sheathing board of about an inch in thickness was fastened "to keep the hair in its place."

It is believed that the art of sheathing vessels was early practised in China: a mixture of fish oil and lime was applied; it was very adhesive and became so hard that the worm could not penetrate it.

The opinions of Sir Richard Hawkins, of François Cauche, and of Dampier, on the practice of wood furring, are then given at length, with extracts from their journals.

The sheathing the bottoms of ships with timber, appears to have been disapproved of by these early navigators. In 1668, the officers of the fleet, then preparing under Sir Thomas Allen for an expedition against the Algerines, petitioned that their vessels might not be thus encumbered, as they were in consequence always unable to overtake the light-sailing unsheathed vessels of the enemy. The petition was granted, upon the condition that precautions should be taken, by cleaning the ships' bottoms very frequently.

In 1670 a patent was granted to Sir Philip Howard, and to Major Watson, for the use of milled lead sheathing; it was not, however introduced without difficulty; nor until an order was issued that "no other than milled lead sheathing should be used on his Majesty's ships." About the year 1700 the lead was acknowledged to have failed, and wood sheathing was again introduced.

Numerous instances are given of the employment of wood as sheathing for ships in celebrated expeditions: the ravages of the worm, the accumulation of barnacles and weeds, are then described; the qualities of the wood employed for sheathing in different countries, both formerly, and up to the present time, are examined, and the author, who undertook the investigation of this subject in consequence of finding how little good information existed in an accessible form, promises the history of metal sheathing in a future communication.—*Trans. Inst. of Civ. Eng.*

## SOCIETY FOR THE ENCOURAGEMENT OF ARTS, MANUFACTURES, ETC.

We fear we have lived to see the last days of this well-designed and once prosperous Institution. We augur this from no less indisputable evidence than that furnished by the published Transactions of the Society itself—the last part of which, for the Session of 1839—40, we have now before us. For a long time it used to be the custom of the Society to issue a goodly volume annually, containing a very respectable collection of interesting papers, embellished with a large number of highly-finished engravings. Latterly, however, half a volume per annum has included, not only the whole of the Society's sessional business, but also some excellent original essays on various branches of manufactures and commerce (to our minds, by far the most valuable portion of the volume,) by the Society's late-respected Secretary, A. Aikin, Esq.* The last year's half volume contained upwards of 400 pp., three quarto, and one octavo copper-plate engravings, as well as a number of explanatory wood cuts; while the part for the Session 1839--40, comprises but a hundred pages of letter press, and only one copper-plate engraving! What a falling off is here! Nevertheless, the price is only one shilling less than heretofore, that is, 5s. instead of 6s. The matters submitted during that period to the encouraging notice of this learned body have been few in number, and with a few exceptions, of a very common place character. The sums distributed as rewards, in money, medals, &c., (for "The Encouragement of Arts, Manufactures, and Commerce!") amounted to no more than £148 5*s.* And how much, patient reader, do you suppose it has cost this *encouraging* society to be so amazingly beneficent? Just £1065 6*s.* 7*d.*" There are other items of expenditure, amounting in all to £1317 14*s.* 9*d.*, but as they appertain to matters not either directly or necessarily connected with the *encouraging* branch of the Society's business, we do not take them into consideration.

Had these matters been reversed, and the £1065 6*s.* 7*d.* been distributed in rewards, at an expense of distribution not exceeding a couple of hundred pounds, some good might have been done, and some real encouragement afforded to poor and struggling inventors. But as it is, the Institution has outlived its utility: not only so, but nearly outlived its means of living, for on reference

* We are glad to find that these Essays, along with several other of the same excellent stamp, have been just published by Mr. Aikin, in a separate form, under the title of "Illustrations of Arts and Manufactures,"—a neat pocket volume, to which we shall take an early occasion of more particularly directing the attention of our readers.

to the present state of its finances, we observe that the receipts of the Society have ceased to be equal to its outgoings, and that to meet last year's expenditure it was necessary to make a considerable draught on the Society's "stock." A very few years more of such a ruinous course of proceeding, and the Society must cease to exist.

## ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

*** *Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for that purpose.*

GEORGE ENGLAND, OF WESTBURY, WILTS, CLOTHIER, *for improvements in weaving woollen and other fabrics; and for twisting, spooling, and warping woollens; also for improvements in the manufacture of woollen doe skins.* Enrolment Office, Sept. 2, 1841.

The first improvement consists in applying the following apparatus to looms, to facilitate the change of pattern:—

To the end of the loom, a frame is fixed, in which a series of bars slide vertically, being guided by openings in the upper and lower parts of the frame; each of these bars has two recesses, or stops in it, differently disposed in each bar: these bars are worked by two levers—one before, the other behind—which, acting in the recesses, lift the bars to different heights, thereby giving the required motion to the treddles. The upper ends of the bars are attached to a series of jacks, and their lower ends to counter-jacks, the other ends of which are connected to the treddles by strings, and so communicate the motion of the bars to them. The two levers are caused to rise and fall by the rotation of a double crank affixed to the driving-shaft of the loom, and by means of the bars, the shed of the warp is opened and closed. Directly opposite the bars is placed the pattern barrel, from which a number of studs project: these studs select the bars and force them against the levers.

A second improvement relates to jacquard cards, and consists in cementing linen, calico, or other woven fabric on one, or both of their surfaces, which are afterwards perforated; and in connecting the cards together, by cementing calico or other similar material to them, and thus forming a hinge of woven fabric, instead of linking them by strings, as is usual.

A third improvement relates to the mode of giving off warp from the warp-beam looms. Instead of the warp-beam being weighted, as usual, the warp is passed round a roller, covered with plush or woollen cloth, beneath the warp beam; this roller is weighted to the required degree, the weight remaining constant, and the warp-beam resting on the surface of the roller. By this arrangement, the warp draws round the roller, which, being loaded with a uniform weight, and being always of the same diameter, causes the warp to be drawn off very evenly, notwithstanding the constantly-varying diameter of the warp-beam.

A fourth improvement consists in a mode of twisting, spooling, and warping woollens, in order to obtain a more uniform warp. The cops containing the yarns are placed on a series of spindles, from which the yarn is conducted to the bobbins, which rest against a friction roller; these rollers receiving motion from any suitable prime mover, communicate the same to the bobbins; if an extra twist is to be put on to the yarns, a quick rotary motion is also communicated to the spindles. The yarns being thus wound on the bobbins, are next placed in the warping machine, and the unwinding performed by means of similar friction rollers.

The improvement in the manufacture of woollen doe-skins, consists in the employment of seven treddles, instead of the number hitherto generally used.

JOHN WILKIE, OF NASSAU-STREET, MARY-LE-BONE, UPHOLSTERER; AND JOHN CHARLES SCHWIESO, OF GEORGE-STREET, ST. PANCRAS, MUSICAL INSTRUMENT-MAKER, *for improvements in constructing elastic seats, or surfaces of furniture.* Enrolment Office, September 2, 1841.

These seats are composed of bars or laths, jointed at their centres, and secured at the ends to the back and front rails of the chairs. The inner ends of each bar are turned down, and two spindles passed through them in opposite directions, being prevented from returning by pins. A spring is coiled round each spindle, which presses against the turned down ends of the bar, and is held on the spindle by a nut and washer. On pressure being applied to the upper surface of the bars, they will be deflected, but as soon as the pressure is removed, the springs cause them to resume their original position.

When applied to bedsteads, each bar has two or more spring joints, and is fastened to the side-rails of the bedstead.

The elastic surfaces thus formed, are covered with cushions, squabs, or mattresses; or they may be stuffed, as is usual, when webbing is used.

The claim is to the mode of making elastic surfaces for furniture, by causing each bar or lath to be composed of parts, connected by elastic spring joints as described.

HENRY NEWSON BREWER, OF JAMAICA ROW, BERMONDSEY, MAST AND BLOCK MAKER, *for an improvement or improvements in wooden blocks for ships' rigging, tackles, and other purposes where pulleys are used.*—Petty Bag Office, September 3, 1841.

In making blocks it has hitherto been customary to keep the grain of the wood parallel with the strap, and in the same direction as that in which the strain acts. The present improvements consist simply in changing the direction of the grain, causing it to lie transversely, or at right-angles to the line of direction of the strain and at right-angles to the strap or band of the block.

JOHN RAND, OF HOWLAND-STREET, GENTLEMAN, *for improvements in preserving paints, and other fluids.*—Enrolment Office, September 4, 1841.

This is another attempt to supersede the old-fashioned bladder colours, and consists in the employment of tin tubes or cases, the ends of which are secured by a double lap joint, or one end of the tube may have a nosel or spout furnished with an air-tight cap. One end of the tube is closed by a lap joint, or by a cap and nosel; the tube is filled by means of a funnel inserted in the open end; a piston working within the funnel, forces the paint into the tube, which, when full, has the other end secured as before described. When the paint is required to be used, it is expressed by squeezing the sides of the tube together, commencing at the bottom, and as the sides remain in contact the admission of air is prevented.

CHARLES THOMAS HOLCOMBE, OF NO. 6, BANKSIDE, SOUTHWARK, IRON MERCHANT, *for certain lubricating or preserving matters for wheels and axles, applicable also to the bearings, journals, and other parts of machinery.*—Rolls Chapel Office, September 6, 1841.

The object of this invention is, to render a certain mineral grease, the production of coal tar, called *naphthaline*, useful for the various purposes of lubrication. And also to render another mineral oil obtained from coal tar, called *dead oil*, applicable in like manner.

First process. The patentee takes 5 cwt. of naphthaline in the rough and crystallized state, and boils it for about three hours with two or three bushels of tar, and about 35lbs. of soda. Sometimes animal charcoal is boiled alone with the naphthaline, and sometimes catechu, or Japan earth is employed. The naphthaline thus prepared with one or other of the above ingredients is strained through a fine wire sieve, and left to cool. Forty pounds of rosin, 30lbs. of bone, or horse fat, 35lbs. of Russia tallow, and 2 cwt. of palm oil are melted together, and this mixture is ground with the prepared napthaline in a common paint mill.

Second process. Three hundred-weight of the prepared naphthaline are ground with about 23lbs. of black-lead, and 20lbs. of Stockholm tar.

Third process. Three hundred-weight of the prepared naphthaline are ground up with 28lbs. of Stockholm tar, and 28lbs, of bone fat, or other fatty vegetable or animal substance.

Fourth process. Fifty or 60 gallons of the dead oil are boiled with about one bushel of tar, or with catechu, or with the two combined: the mixture is strained, and left to cool, and afterwards bagged as sperm oil is usually bagged. Two pounds of sperm oil, or of horse grease, are added to each gallon of the mixture.

The patentee does not confine himself to any particular mode of manufacturing, nor to the precise proportions, but claims solely the use of naphthaline and of dead oil as the basis of his invention in lubricating and preserving matters.

BENJAMIN SMITH, OF STOKE PRIOR, NEAR BROMSGROVE, BUTCHER AND PUBLICAN, *for an improved apparatus for makingsalt from brine.*—Rolls Chapel Office, September 8, 1841.

This improved apparatus is heated by fires disposed as usual, in fire-grates, situated side by side beneath one end of a large horizontal salt-pan, in order to give heat thereto, partly by direct action of the fire upwards, and partly by the action of flame, heated air, &c., which proceeds backwards, beneath the back part of such pan; but the sides of such fire-places, instead of being brickwork, as usual, are, in this improved apparatus, the sides of iron vessels containing water, and these vessels, so heated, generate steam, which is conveyed upwards by suitable pipes into spaces beneath the bottoms of other additional salt pans which may be situated over the first salt pan, in order to heat the brine in such upper and additional pans. At each side of so much of the foremost end of the first salt pan as is over the fires, and over the vessels at the sides of the fire-places, a deeper part, called a pocket, is provided to receive the salt; the pockets being two long narrow troughs, whereof the bottoms descend below the level of the flat bottom of the pan, in order that such pockets may be adapted to receive the fine salt which deposits itself on the bottom of the pan, the deposited salt being swept at short intervals of time from all parts of the said flat bottom, into the pockets, by means of a scraper, or row of scrapers, moved horizontally by suitable mechanism.

The description of this simple apparatus is most voluminously set forth in five skins of

parchment, which compose the specification, accompanied with illustrative drawings, without which it is difficult to give a more intelligible idea of the arrangement than is afforded by the above outline, and the following claim, viz., the combination and arrangement of the several parts of the apparatus one with another, as hereinbefore described, and particularly in the application of water vessels at the sides of the fires, (which fires are disposed in fire-grates in their usual positions beneath the bottom of the salt pan,) together with the connecting passages and pipes between the said water vessels, in order that the water in such vessels, passages, and pipes, may receive heat by lateral action from those fires, so as to produce steam, which is conveyed by the system of pipes hereinbefore described, to give heat to brine in other additional pans for the purpose of making broad salt therein, in the manner hereinbefore described; and although salt pans with double bottoms, to be heated by introducing steam into the spaces between those bottoms, are not claimed as a new invention, yet part of the present invention consists in making the uppermost of the two bottoms of such additional steam-heated salt pans, convex, so that the brine will stand deeper at the sides of such pans, than it does at the middle of their width, as hereinbefore described. Also in the system of pipes by which a circulation of water is kept up within and through the said water vessels, at the sides of the pipes, as hereinbefore described. Also in the application of the particular kind of close cover, or steam vessel, hereinbefore described, over that salt pan which is heated by the fires beneath it, in order to receive the steam arising from the boiling brine, that close cover, or steam-vessel having a pan above it, wherein cold brine is to be heated by the said steam, as hereinbefore described, in preparation for introducing that brine into the aforesaid salt pan, which is situated over the fire, as well as into the backmost part of the same pan. Also in the several modes hereinbefore described, of actuating scrapers for removing the loose salt from the bottom of the principal salt pan which is situated over the fires, and beneath the aforesaid close cover, or steam-vessel.

LIST OF IRISH PATENTS FOR JULY, 1841.

J. Ransome and C. May, for improvements in the manufacture of railway chairs, railway and other pins, or bolts, and in wood fastenings and tree-nails.

W. Petrie, for a mode of obtaining a moving power by means of voltaic electricity, applicable to engines and other cases where a moving power is required.

J. B. Humphreys, for certain improvements in shipping generally, and in steam vessels in particular, some of these improvements being individually novel, and some the result of novel application, or combination of parts already known.

J. Haughton, for improvements in the means employed for preventing railway accidents resulting from one train overtaking another.

M. Poole, for improvements in tanning, and dressing, or currying skins.

DITTO FOR AUGUST, 1841.

Edward Foard, for an improved method or methods of supplying fuel to the fire-places, or grates of steam-engine boilers, brewers' coppers, and other furnaces, as well also to the fire-places employed for domestic purposes, and generally to the supplying of fuel to furnaces, or fire-places, in such a manner as to consume the smoke generally produced in such furnaces or fire-places.

W. Newton, for certain improvements in machinery for making pins.

NOTES AND NOTICES.

*Advantages of Trans-Atlantic Steam Navigation to Manufacturers and Commerce.*—On the 31st of July a leading London merchant received an order by the mail which left New York on the 18th July, for 300 tons of edge-rails for the Long Island Railway: he advised completion of the contract from the manufacturers, at the Dowlais Iron Works, by the packet which sailed from Liverpool on the 4th of last month; and the steamer of the 19th will carry a bill of lading of their shipment on board the *Cosmo*, of this city, being within a month from the date of the order at New York.—*Bristol Mercury.*

*Quality and Quantity.*—All those articles which require very minute and delicate manipulation, and which are almost entirely the work of very delicately-instructed fingers, and are made in small quantities, have been, and will continue to be made in France and on the continent cheaper and more beautiful than they can be made in this country. The demand for such articles is, however, extremely limited; but an infinite variety of styles and patterns are continually required, whatever is the description of goods, silk, cotton, or metallic. Goods that are required in great abundance in the common markets of the world always have been, and can be made cheaper and better in England than in any place on the continent. Watches are made better and cheaper in Coventry than they can be made on the continent, even in Switzerland, the very centre of watch-making; and whenever the continental manufacturers have beaten the English manufacturers in markets to which they both had access, it is found to be in articles where very delicate manipulation is required. We never, with any sort of protection, could hope to beat the Lyons silk manufacturers, but in large piece-goods we can and do beat them.—*Mr. J. C. Dyer, Meeting of Manchester Chamber of Commerce.*

*Erratum* in our last Number, page 210, first column, 22nd line from top, for "*stem*," read "*stern*."

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Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 946.] SATURDAY, SEPTEMBER 25, 1841. [Price 3*d*.
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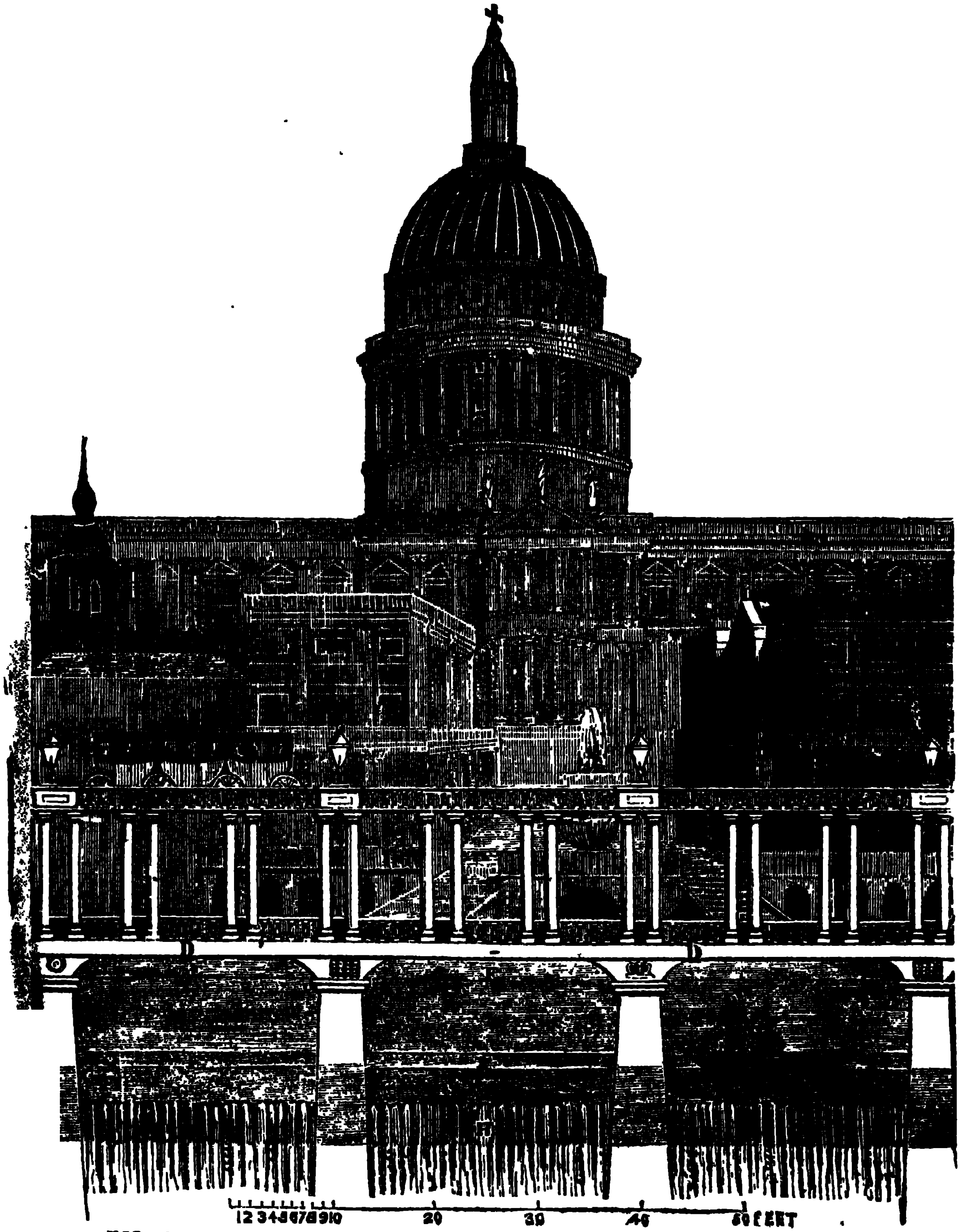
# EMBANKMENT OF THE THAMES—LONDON BRIDGE AND HUNGERFORD RAILWAY.

Fig. 1.



Fifteen years have elapsed, since Sir Frederick Trench made a zealous, but unsuccessful endeavour to enlist the support of the public in favour of a plan of his, for the formation of a quay along the north bank of the Thames, from Westminster to London. The plan was not, to be sure, so original as the gallant proposer imagined; for something of the same sort had been repeatedly proposed before—once by the immortal Wren, and, at a later date, by the brothers Adams, who gave in the Adelphi, a specimen of what they desired to see executed along the whole of the north side of the river; but it was an excellent plan for all that, and great praise was due to Sir Frederick Trench for the spirit and ability with which he advocated its adoption. It was a plan, combining at once prodigious utility, with surpassing grandeur and beauty. A new and spacious thoroughfare was to be opened between the East and West ends of the metropolis; Cheapside and Fleet-street, and the Strand were to be relieved of the excess of traffic, which even at that time, was matter of grievous complaint, and is now ten times greater than it was then; banks of pestilential mud were to give place to a clean shore edged by a noble terrace, available alike for purposes of business and of pleasure, with open archways or small docks beneath for the accommodation of boats and barges; the noble and picturesque Thames was (at last) to be thrown open to the universal gaze, and made to contribute its due share to the embellishment of the metropolis and the comfort and delectation of its inhabitants; and all these great, and unquestionable benefits, were to cost the public literally nothing—the value of the building ground to be created by the embankment and acquired by the pulling down of existing buildings, being estimated by good authorities to be far more than adequate to defray all the cost of the projected improvement. But the plan, nevertheless, fell to the ground. " A number of influential individuals," Sir Frederick Trench says in a letter to Lord Duncannon, just published,* "gave their support to my proposition; but some persons of rank residing upon the banks of the river were opposed to it; and others in the trading districts, who would have derived positive advantages from the proposed plan, set up claims of compensation; many other difficulties presented themselves; but above all, *want of funds.*" Judicious John Bull could find hundreds of thousands to throw into the Thames, for the sake of boasting of a bigger and at the same time, more useless tunnel than all the world besides; but little beyond the faintest good wishes, had he to spare for an improvement in the face of the river, which was calculated beyond every other to render his capital the admiration and envy of surrounding nations."

* Letter to the Viscount Duncannon, First Commissioner of Woods and Forests. 12 pp. 4to, with two plates, July, 1841.

Circumstances have since greatly changed—for the worse, as regards the comfort and convenience of the public, but for the better as far as concerns the projected embankment and its prospects.

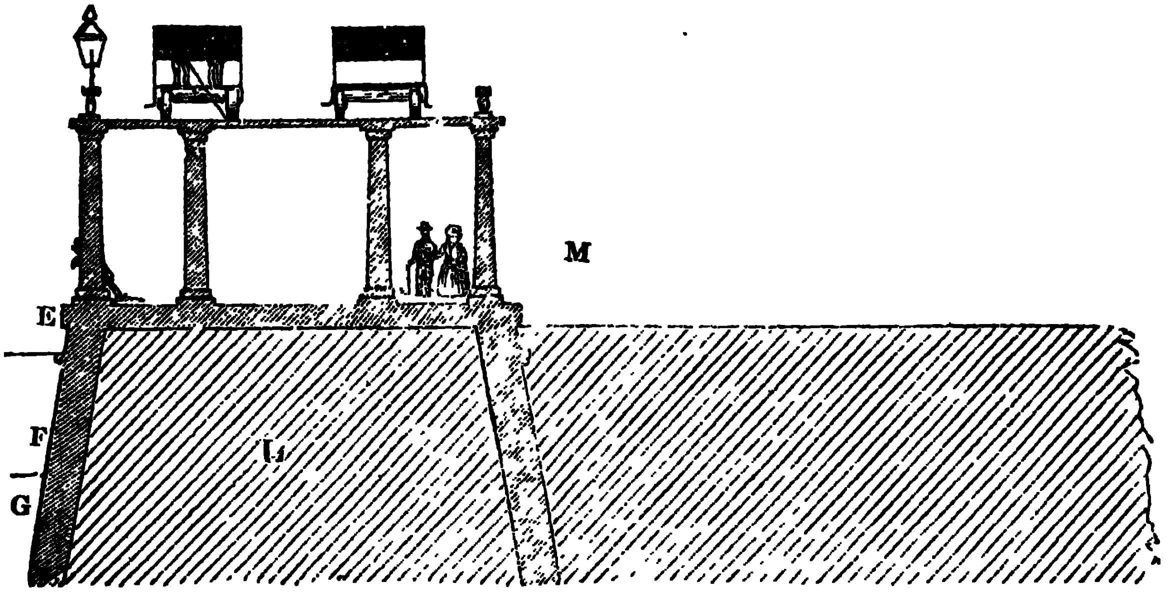
" The removal of the Old London Bridge and the erection of the new one, produced the effects that were anticipated. Shoals increased to impede the navigation, mud banks accumulated, and ' a larger surface of the bank of the river at low water being exposed, therefore, the injurious or unpleasant effects from a discharge of the sewers is greater than before !'* But the erection of the terrace on which the houses of parliament are to stand, has very much aggravated those evils ; the irregular efforts at dredging the river have created banks on which the backs of barges are frequently broken, and on the 14th of June 1840, eight boats with passengers were seen aground upon these new shoals at one moment. ' The banks of mud have increased in size and consistence ; and near Westminster, where we used to have 5 feet water before the embankment took place, it is now all filled up with mud ;" lower down the banks are covered with vegetation, which, being manured by the sluggish filth from the sewers, present the strange spectacle of a rich green crop, and make the air absolutely pestilential."

Again,—

" Those very persons who were violently opposed to what I thought a most splendid and magnificent and useful improvement, are now eager to adopt it, as the only remedy for an intolerable nuisance."—Letter, p. 2.

* House of Commons' Report on Thames' embankment, July 29, 1840.

Fig. 2.




The Railway system too, has, since 1825-6, sprung into full life and vigour, and has suggested an addition to Sir Frederick's original scheme (so at least, speaking from recollection, we take to be the case) which adds immensely to its value. The terrace, it is now proposed, shall be surmounted by a railway, supported on columns, by which a person may be conveyed from one end of the line to the other in less than five minutes; that is to say, the river front of it is to be converted into a vast colonnade, affording shelter from sun and rain to leisure promenaders beneath, while persons to whom quickness of transit is an object, may avail themselves of the flying conveyances overhead.

On all these grounds, Sir Frederick Trench has been induced to bring his plan once more before the public—anticipating "zealous co-operation, where in 1826 he found strong opposition," and confidently trusting, that a year or two more will not elapse before it is in the course of execution. Most earnestly do we hope his anticipations may be fully realized.

But though amended to the extent we have just stated, Sir Frederick's plan has also undergone considerable, and we must say, most injurious curtailment. Formerly the terrace was to have reached to Westminster Bridge, but now it is proposed that it shall stop at Hungerford Market. We regret to have to infer from this, that among the changes which have taken place since 1826, there is little, if any, in the feelings of the "persons of rank residing on the banks of the river," towards the projected improvement. The part left out between Hungerford Market and Westminster Abbey, is the *only* part where "persons of rank" reside. True, Sir Frederick tells us that a terminus at Hungerford Market will place all the passengers from the city in the great connecting point of traffic, whether *westward* towards Pall Mall, St. James's, Piccadilly, and Hyde Park Corner; or *southward* towards Westminster Hall, Westminster Abbey, and the Houses of Parliament;" but would the convenience to the passengers *southwards* be lessened, were they to be enabled to go straightforward to the Hall, the Abbey, or St. Stephen's—which to those in the railway carriages would not occupy an additional minute — instead of being obliged to turn off at Hungerford-market, and go round by the old and circuitous route of Charing-cross, Whitehall, and Parliament-street? No—it is manifest that the convenience of the public at large is proposed to be sacrificed to the will and pleasure of the magnates of Northumberland-house, Montague-house, &c.; a sacrifice the more uncalled-for and inexcusable, that it is "perfectly practicable," as Sir Frederick Trench has elsewhere shown, to extend the embankment to Westminster-bridge, in such a manner, "as not to be the slightest annoyance" to

a single resident on the banks of the river, however exclusively or daintily inclined he may be.

The manner in which Sir Frederick proposes to work out his plan, so far, will be found explained in the following extracts from his letter to Lord Duncannon.

"I propose to begin the embankment and railroad at Hungerford Market—to continue both to London Bridge, and I would face the whole with stone, or with plates of cast iron to imitate stone. The breadth of the railroad should be 30 feet, supported on columns 13 or 14 feet high. I calculate the whole of the embankment at 4 feet above high water of the Trinity standard. In my sketch I have made the arches from 2 to 4 feet wider than the widest barge, but they may be constructed of any width that may be deemed better, either for convenience or beauty, and each pier will occupy the space of a certain number of dwarf piles. In passing through the arches at the very top of high water, the barges will have 3 feet of head room, and every minute after will give greater facility of access; and any amount of air and light can be obtained by gratings in the promenade.

"I tried various modes of finishing the walls of the embankment to the river, First, by throwing them into panels — and again, by making blank arches to correspond with the open ones * * * * * but, on the whole, I incline to prefer the simple, solid, rustic wall. The colonnade would be just the height of the portico at the Pantheon, in Oxford-street, and the entablature and balustrade should be of the most chaste and simple description. Calculating upon so large a fund, as I confidently anticipate, I would propose that all the ground reclaimed from the muddy banks of the river (except so much as is necessary to form a carriage road along the side of the promenade) should be disposed of and arranged on *terms the most advantageous, and in the manner most agreeable* to the owners of the property on its banks. The Government can well afford to conciliate them all, and of every class, by the most liberal treatment. We may expect to see wharfs, warehouses, and dwelling-houses erected hereafter, and they ought to be built according to such handsome architectural designs as the Government may approve. I think the alternation of arches, with a rustic solid wall, will produce a pleasing variety. The ornaments in the spandrils of the arches (the crown, the rose, the portcullis, or any others) may be of cast iron, (which is cheaper than stone,) and the columns, entablature, and balustrades, the cross beams, and frame of the railroad terrace, should all be of the same material. The carriages must be made as low as is consistent with convenience, and should be moved (as on the Blackwall Railway) by a stationary power, and be arranged so that each carriage starts from its station at the same moment, and all arrive in due succession. The mode of stopping a carriage, or discharging it from the rope when in full action, is safe, simple, and effective. The electrical telegraph, employed to give signals along the line, may be made available to carry orders from the Admiralty, or the Treasury, or the Board of Trade, literally *with the speed of light*. I saw a message transmitted from the Minories to Blackwall, and an answer (containing several words) returned in less than one minute. I propose the rails for the trains to be of wood, so that there will be no more noise than when a carriage passes over a wooden pavement, and those who have walked under the galleries in the Quadrant, in Regent-street, may form an idea of what the proposed promenade will be, by imagining the two trottoirs of the Quadrant brought together, supported on four columns, and continued for one mile and three quarters, protecting those who walk under it from sun or rain, but with the option of walking in the open air if preferred. The height of the whole railroad must, of course, be regulated by the height of the lowest arch under which it will have to pass."

The cost of the work—the estimates for which have been examined and approved of by Mr. Walker, Mr. Bidder, and Sir Frederick Smith, all very competent judges—is expected not to exceed 435,000*l.*; and the clear annual revenue from the passengers by the railway is estimated by Sir Frederick Smith and Mr. Bidder at 62,052*l.* 10*s.*, which, at twenty-five years purchase, will represent a capital of 1,551,312*l.* 10*s.*, leaving a net surplus of 1,116,312*l.* 10*s.*, exclusive of the value of all the new building ground acquired by the improvement, which might be reasonably expected to produce at least half as much more.

Here is an immense money gain, from what would be in itself a public improvement beyond all price; and this Sir Frederick proposes to employ in effecting two other improvements of a most desirable description.

"First, in completing an embankment on the South side of the River, and giving every possible accommodation to the occupants of its banks;—and next, in opening to the River that beautiful portico and front of St. Paul's

**opposite to Paul's Chain, and forming a street from thence to the River, terminated by a fountain and jet d'eau, with a double flight of steps to the water.**

The engravings accompanying this notice are copied from the plates in Sir Frederick Trench's Letter to Lord Duncannon, with a few slight alterations for the sake of concentrating the details.

Fig. 1 shows the terrace, colonnade, railway, and objects at the rear, as they would appear in the event of a street being opened up from the river to St. Paul's.

D is the colonnade, 30 feet wide, with platform at top for railway carriages, and promenade underneath.

E, high-water mark, according to the Trinity standard.

F, half-ditto.

G, dwarf piles.

H, low-water mark.

Fig. 2 is a section of the embankment, terrace, &c.

M, the ground gained by the embankment, applicable to the purposes of a carriage-road, or for buildings.

E, the high-water mark.

F, half-ditto.

H, low ditto.

Sir Frederick concludes with a wish in which we cordially join.

"I do most anxiously hope that this great national work will be undertaken by the Government, and not permitted to pass into the hands of any company. Under the direction of the Woods and Forests, and the skilful superintendence of their engineers and architects, the work will be done handsomely, substantially, and speedily; and I should be very sorry that such profits as I anticipate, should pass into the pockets of speculators, instead of being applied, as it would be by a fair Government, to the improvement of the River, and the embellishment of its banks."

## THAMES AND CLYDE STEAMERS.

Sir,—In due time I perceive notice taken of my letter by two individuals, one of them having screwed his courage up to the direct puff point, and given "his name at full length, to show that he has no sinister interest to serve."

Mr. Bayley says, he saw that the *Robert Burns* was not nearly so fast as the slowest of the Gravesend boats; but may I ask him, were circumstances alike favourable to each? One question more—how comes it that the Company who own the *Grand Turk*, (a vessel which, according to "L. P.," has cost them four times as much as a similar boat made about twelve months after the *Turk*,) have bought these two vessels, viz. the *Wallace* and *Burns*, from the same person that they bought the *Turk*? Of course they must have had every opportunity of knowing the speed, expenditure of fuel, and wear and tear of machinery, in the case of the *Grand Turk*, as compared with vessels by other builders, before they ventured on these further purchases.

"L. P." has given a pretty correct statement of the dimensions of the *Wallace*, but as to the 60-horse engines, that is only a nominal power. I suppose they are 60-horses, worked with steam equal to the atmosphere, and an average vacuum of 10 lbs. upon the square inch of the piston. Now the *Wallace* is worked with steam 7 lbs. above the atmosphere, making a vacuum of about 12½ lbs. on the average, which will be about double the nominal power. Will "L. P." be so good as to mention the pressure the *Duchess of Kent* carries in her boiler; the vacuum she makes, the diameter of the cylinders, the length of stroke, or the number of feet the piston travels per minute, the diameter of paddles over float-boards, and about the average speed she goes at? The diameter of the *Wallace's* paddles are, I think, 16 feet; length of stroke, 3 feet 9 inches; about 28 to 29 revolutions per minute. If the engines do the same proportional work, and the vessels do not go alike, there must be some error in the build of the boat, which may be remedied. By-the-bye, the 15 tons of coal which the *Wallace* had in her after-hold would materially injure her speed. I am told by a person who has every opportunity of knowing, that she never went as well when she was trimmed in the way "L. P." mentions. I think both vessels laboured under a disadvantage, seeing that there were strange hands in them, who, it seems, did not know their trim.

I remain, yours, &c. A. M.

Glasgow, Sept. 13, 1841.

## THAMES AND CLYDE STEAMERS.

Sir,—Your correspondent, "A. M.," in No. 938, of your valuable journal, in speaking of the assumed superiority of Clyde, over Thames-built steamers, singles out the *Grand Turk* as an example, and speaks of the great satisfaction she has given her owners, the Commercial Company, — 1st, on account of her speed; 2nd, on account of her requiring little repair; and 3rd, on account of her small consumption of fuel. Now this boat formerly ran between London and Boulogne, and was never considered equal, either in speed, beauty or economy, to the *City of Boulogne*, a London boat, belonging to the same Company. She now runs between Southampton and Havre, in opposition to the *Hamburg*, a French steamer, and is almost invariably beaten by her foreign opponent, sometimes as much as two hours and upwards in the passage of twelve. If the Commercial Company are satisfied with this, they must be very easy folks. On the subject of repairs, if she has never had any, it is high time she had, and pretty extensive ones too, as her sheer is dreadfully broken, and she appears in a very dilapidated state compared to most of our Thames vessels. Concerning the consumption of fuel, I am unable to ascertain the quantity burnt by the Commercial Company's boats in general, but I can answer for it, that she consumes more than the *City of Boulogne* or *Emerald*. The *William Wallace* I have frequently passed in different Gravesend boats. She may be a good tug, but cannot be expected to compete with our passage vessels. Your correspondent asks why London Companies go all the way to the Clyde to buy steam vessels, being provided with such good ones here? To which I answer, for the same reason other persons buy bad articles—on account of their cheapness.

Yours, &c.,

SHIPWRIGHT.

September 10, 1841.

## THE THAMES STEAMERS AND BRISTOL RIVALS.

Sir,—The immense increase of steamers on the Thames during the last few years, has given rise to so much opposition, and a variety of form of engine, that a very high speed has been attained by some of them, particularly since the *Father Thames* was placed on the Gravesend station. The steamers belonging to the Directors of the Blackwall Railway Company, are among the fastest. The *Blackwall* is the "crack boat," though her speed is not obtained by quite such *fair* means as the *Father Thames*. I never saw so much power applied to so small a boat. She is worked by a 90-horse power engine made by Messrs. Miller, Ravenhill, and Company, and rather high steam pressure. On asking the engineers what is the pressure, all the answer to be got is, that they don't know—only they don't work so high as many other boats on the river, &c. Why is this concealment? The steam strikes with such force upon the piston at the commencement of the stroke, that the shock is felt all through the vessel. The *Satellite*, a new boat belonging to the Star Company, is one of the fastest on the river, she has two 35-horse power engines of the same construction as the *Blackwall*, and by the same makers. There is an iron boat now building at Bristol, to be called the *Little Western*, and will shortly be finished, which is intended to beat all the Thames steamers. They have hitherto been unrivalled, and it is to be hoped the Londoners will not allow Bristol to "go a-head" of them.

I am, Sir,

Your obedient servant,

A MECHANIC.

September 8, 1841.

## WOODEN TYRE FOR RAILWAY WHEELS —PROPOSED IN 1830, BY SIR GEORGE CAYLEY, BART.

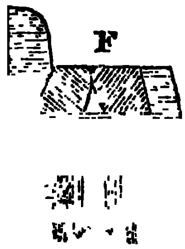
Sir,—I have observed that several persons claim the invention of wooden tyre for the wheels of railway carriages, and that by an article in the *Mechanics' Magazine* of last month, it seems clear that Mr. Frost of Derby, has the earliest claim to it, he having made a model of such a wheel previous to the 30th of November, 1830.

I have no wish to obtrude upon the credit due to Mr. Frost, neither will he object to my calling your attention to the fact of my having published in your magazine for May, 1831, in a letter bearing date December 5, 1830, the following paragraph, accompanied

by a sketch of the wooden tyre railway wheel, of which I send you a copy.

"If the wear and tear of railway conveyance be found too expensive, owing to the friction caused by such high pressure and great velocity, and that the use of springs to these carriages is not sufficient to cure the evil, I think it probable that a dove-tailed groove, filled with hard oak, driven in in small pieces, endwise within the rims of the wheels, and then turned in a lathe till circular, might be serviceable, and could be cheaply renewed; these pieces might be screwed in their bed by a Fox wedge, as commonly practised in similar cases." (See Fig. 6.)

Fig. 6.





I shall only remark that I have patented a particular construction of a wooden tyred wheel in April, 1837, and am, Sir,

Your obedient servant,

GEORGE CAYLEY.

Brompton, Yorkshire, Sept. 16, 1841.

ON THE PERCUSSIVE ACTION OF STEAM AND OTHER AERIFORM FLUIDS.—BY JOSIAH PARKES, M. INST. C. E.

[From the Minutes of the Transactions of the Institution of Civil Engineers.]

In a previous communication, "On the Action of Steam in Cornish single-pumping Engines," Mr. Parkes, after a careful analysis of the ascertained facts of the quantity of water which, in the shape of steam, passed through the cylinders of the engines, arrived at the conclusion, that the steam's elastic force was insufficient to overcome the resistance opposed to it. On obtaining this remarkable result, he was induced to examine the circumstances under which the steam is applied, and was convinced that, from the instantaneous and free communication made between the boiler and the cylinder of these engines, an action, distinct in character from the simple pressure of the steam, must be transmitted to the piston. And, in order to convey some precise idea of the peculiar nature of this action, he adopted the term "percussion," to distinguish such action from that due to the simple elastic force of the steam. Various phenomena, connected with the working of the engine, were adduced in confirmation of the views then advanced. In the present communication Mr. Parkes has resumed the subject, and brought forward numerous facts derived from experiment and observation, on steam and lastic fluids generally, in farther corroboration of his opinions respecting the percussive action of steam in engines.

The effect of the percussive action of steam may be clearly traced on the indicator diagrams, (a series of which, forty-one in number, taken from four engines, with different indicators, the pressure of the steam varying from 6·5 to 34·7 lbs per square inch, accompanied the communication,) and it will be seen that, in every instance, the piston was driven to a greater height than that due to the simple elastic force of the steam; in many instances a greater pressure was* marked than existed in the boiler. The difference in the action, according as the steam is admitted suddenly, or gradually, into the cylinder of the engine, may be also distinctly traced on the diagrams.

The same effects were observed on the sudden admission of steam upon the surface of mercury in the cistern of a mercurial column. In these experiments, the steam being let on gradually, the gauge marked a pressure of 40 lbs. per square inch, which was the true pressure in the boiler; but, being admitted suddenly, the gauge exhibited a pressure of at least 60 lbs., and the same results were repeatedly obtained.

The steam generator of Mr. Perkins will afford a good illustration of the effect of the steam's instantaneous action. The pressure in this apparatus is denoted by an instrument having an index moving round a dial-plate. Steam of 26 atmospheres being suddenly admitted, the index was observed, during repeated trials, to register a pressure as high as 36 atmospheres, and then to recede until it remained stationary at 26 atmospheres, which was the pressure in the generator.

The results of these various experiments are arranged in two tables, exhibiting an analysis of the elements into which they may be resolved.

The author then proceeds to point out the different circumstances of the pumping and crank engines, in respect of realizing, beneficially, the steam's percussive action. In the latter, this instantaneous action takes place, (as the indicator diagrams show,) when the connecting rod and crank are in one vertical line, so that it is inefficiently expended; the centre, by the agency of the fly-wheel, not having been passed. In the former, the load and frictional resistance alone oppose the descent of the piston; the piston is free to move, and the steam's action is wholly efficient in impelling it; and, whatever the amount of the percussive action it will be accounted for in the effect.

A remarkable confirmation of the conclusions arrived at, and the views advanced by Mr. Parkes in his previous communication,

had been furnished by Mr. W. West. The cylinder cover of the Fowey Consols engine, 80 inches in diameter, and weighing 4 tons, springs upwards at the centre $\frac{5}{32}$nds of an inch, on the sudden admission of steam, which in the boiler has a pressure of 49·7 lbs; and $\frac{8}{32}$nds or $\frac{1}{4}$th of an inch, the steam in the boiler being 61·7 lbs; but no change of form, or springing, occurs when the steam is let on gradually, and fills the cylinder at the same pressure as that in the boiler.

The author adduces many other facts in illustration and confirmation of his views; as, the oscillation of the mercury in steam and vacuum gauges; the audible sounds produced in a steam-pipe on suddenly checking the motion of the elastic fluid by shutting a cock; the curious phenomena connected with the impact of elastic fluids on each other, particularly those observed by Mr. Greener on firing gunpowder in long open-ended barrels; and, in conclusion, suggests whether these remarkable facts may not serve to assist in elucidating some of the very difficult and apparently inexplicable phenomena, connected with the explosion of steam-boilers.

Mr. Lowe stated that he had recently made some experiments, which in his opinion confirmed Mr. Parkes's views on this interesting subject.

A pressure gauge, attached to a line of gas-pipes, showed, when the communication was slowly opened, a pressure of 4 inches column of water; but it invariably exhibited a maximum of oscillation of full 6 inches column on the sudden opening of the small stop-cock between the pipe and the gauge.

In a line of pipes full of gas, the whole volume of gas received an impulse on suddenly opening the valve at one end, and the passage of the undulating wave was indicated by the sudden and successive depression of the water in the gauges along the whole line.

Mr. Homersham could not agree with Mr. Parkes as to the effect due to what he termed the "percussive action of steam:" he believed that the superior economy of the Cornish engines, as far as related to the action of steam in the cylinders, would be found to be due to the amount of the expansion of the steam, which depended, not only upon the opening and closing of the steam-valve, but also upon the greater or less area of the aperture of the throttle-valve. It was evident that on closing the steam-valve, the space between it and the throttle-valve would be filled with steam of a density nearly, or quite, equal to that in the boiler; therefore, on the first admission of the steam into the cylinder it might be presumed to act upon the piston with that pressure; considering, likewise, that a short interval of time necessarily occurs after setting in motion the beam with the heavy pump-rods appended to it; but immediately the piston starts, expansion takes place, as the throttle-valve prevents the steam from following the piston freely, so that a greater degree of expansion must take place when the steam is at a higher density, for the throttle valve being then more closed, offers a greater resistance to the steam following the piston. The indicator diagram of the East Crinnis engine showed this effect to a certain extent, although neither in that, nor in the diagram of the Huel Towan engine, was there nearly the same degree of pressure exhibited in the cylinder at the commencement of the stroke, as in the boiler; but it was evident that those diagrams could not be relied upon, as they did not account for the whole duty done by the engines, either on the percussive, or the expansive principle.

Assuming a bushel of coal to weigh 94lbs. as generally reckoned in Cornwall, and that 1lb. of coal would evaporate $10\frac{1}{4}$lbs. of water, it could readily be shown that the quantity of water converted into steam by one bushel of coal, would, when expanded in a cylinder, during $\frac{19}{20}$ths of the stroke, lift upwards of 257,000,000lbs. one foot high in one minute, which was a much greater duty than was realized by any Cornish engine.

Mr. Seaward allowed that Mr. Parkes had clearly shown, that a certain amount of effect was due to the sudden impact of the steam upon the piston of a pumping engine. Whether the term "percussion," as applied to this action, was the proper one, he would not then examine; but the effects shown to have been produced, and the phenomena attendant upon the exhibition, were so remarkable, that he conceived the subject to merit the most deliberate investigation of engineers as well as philosophers. He had previously objected to the theory, on the ground that the effect could only be in the ratio of the weight of the steam multiplied into its velocity; but he believed the subject must be examined in a different manner; and although the principle must always have existed, it was only in consequence of modifications in the aplication of steam, that the effects had been so fully developed.

Mr. Parkes mentioned, that since his paper had been written, he had found an experiment which was strictly analogous to his proposition. It was related by Mr. Robins, who was so justly celebrated as a mathematician and philosopher, and first discovered that the gas evolved from gunpowder was a permanently elastic fluid.

"When gunpowder is fired in an exhausted receiver, the mercurial gauge instantly de-

scends upon the explosion, and as suddenly ascends again. After a few vibrations, none of which, except the first, are of any great extent, it fixes a point which indicates the density of the enclosed gas."

He considered this result as corroborating those obtained by himself, as well as justifying the comparison he had drawn between the instantaneous action of gunpowder gas and steam. Mr. Robins' words precisely described the steam's action, as traced on the indicator diagram exhibited.

The springing of the cylinder cover referred to, and in the manner stated, must, he thought, satisfy every one, that the steam's instantaneous action far exceeded in effect that of its simple elastic force, which was proved to have been unequal to produce any change in the parallelism of the cover.

As regarded Mr. Homersham's investigation of the power of the steam in the Huel Town Engine, it was correct that the initial steam was in a state of expansion during $\frac{18}{20}$ths of the stroke, but not all the steam, for it had not all entered the cylinder until the piston had travelled through nearly $\frac{5}{20}$ths of the stroke. His calculations were, therefore, hypothetical, and not in accordance with the facts of Mr. Henwood's experiment.

## ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

*** *Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for that purpose.*

THOMAS HAGEN, OF KENSINGTON, BREWER, *for an improved bagatelle board.* Enrolment Office, Sept. 7, 1841.

In this improved bagatelle board, the end of it, where the numbered holes are usually placed, is occupied by a moveable platform, with cups sunk in it; the platform being covered with a map, or with figures of animals, birds, or insects, each county or figure occupying a cup.

In playing with this bagatelle board, when a ball is struck into one of the cups, instead of counting the number as usual, the player is to be questioned by his adversary as to the name of the county, &c., appertaining to that particular cup, and if the player answers correctly, he is to count one towards the game; if he fails to do this, and his adversary answers correctly, he (the adversary) counts one. If neither answer rightly, neither can count anything for that ball. An index accompanies the instrument, in which the name of the county is found opposite the numbers of the several cups for the purpose of reference. The object of this invention is said to be to blend instruction with amusement. *Vive la Bagatelle*

JAMES JOHNSON, OF GLASGOW, GENT. *for improvements in the machinery for frame-work knitting, commonly called hosiery; and for certain improvements in such frame-work knitting, or hosiery.* Enrolment Office, September 8, 1841.

In this improved machinery, the needles are made with an extremely short hook, and are inelastic, each having a lateral slot for receiving the points by which the loops are taken off the needles. The thread, which is supplied from above, is distributed over the needles by a carrier; it is then caught by the beaks of a series of levers above the needles, and pressed into the spaces between a series of jacks (also above the needles) instead of pressing it between the needles as usual. The thread being thus distributed, and the loops formed by the movement of the levers, the depression of the loops for the purpose of forcing them on to the needles, is then effected by the descent of the jacks, and at the same time the withdrawal of the needles takes place. As the main shaft revolves, the needles are forced forward for the purpose of narrowing, but they are immediately forced back again by the action of the machinery; The loops are taken off the needles by a series of needle points on a horizontal bar, at the same time, the previous movements are repeated, and a new loop is placed in the hook of each needle; the needles are then forced backward, and the needle points rising, and immediately retiring, the loop they hold is liberated, and falling over the new loop in the needle hook, the stitch is completed.

The narrowing of the work is effected by part of the machinery, which is thrown into action by the operator when required, and which, when in action, proceeds regularly on with the work, reducing a loop in each selvage at every fourth course, by removing the loops from the two outer needles, on to the needles next to them; and at the same time limiting the traverse of the thread-carrier to supplying the diminished number of needles.

The improvements in frame-work knitting consist:—Firstly, In a new fabric, in which a separate thread is used with each needle. This is accomplished by substituting for the levers before described, a series of distributors, each carrying a separate thread, and the loops are formed on the needles by the whole of the distributors being supported upon a traversing frame: each distributor forming loops for two needles alternately.

Secondly, In a fabric having a plush or piled surface, in the manufacture of which, two threads are employed. In this case, the loops, instead of being formed by the action

of the levers, and jacks, as before, are formed over the needles by descending jacks of a peculiar form moving in succession, as in the common stocking frame. A distributor passes along the needles while the jacks are elevated, distributing one thread in the opening above the cutting edge of the jack, and the other thread upon the needles. When the traverse is completed, the jacks are successively lowered, and two loops are formed on each needle, one long, the other short. The needles then retire and perform the movements necessary to form the stitch, when the jacks are elevated, and the long loop is cut, forming the pile or plush in the surface of the cloth, while the short stitches form the ground work, or basis of the fabric.

Thirdly, In a fabric composed of the ordinary frame-work stitch, but formed into a cylinder without any join or seam.

STEPHEN GOLDNER, OF WEST-STREET, FINSBURY-CIRCUS, MERCHANT, *for improvements in preserving animal and vegetable substances and liquids.* Enrolment Office, September 8, 1841.

In order to heat the vessels or cases in which animal or other matters are to be preserved, a solution of muriate of lime or nitrate of soda is placed in troughs not quite so deep as the cases. The solution is heated by steam-pipes or otherwise, and the cases being placed therein, the atmospheric air is expelled and a partial vacuum produced within them, when they are closed hermetically. By this means a constant and equal temperature is maintained, without any liability of the matters operated upon to be injured by an excess of heat, as they are when stoves or ovens are employed for this purpose.

JOHN WERTHEIMER, OF WEST-STREET, FINSBURY-CIRCUS, PRINTER, *for certain improvements in preserving animal and vegetable substances and liquids.* (A communication.) Enrolment Office, September 8, 1841.

The substances to be preserved are to be enclosed in tin cases, in the cover of which two holes are to be made, the one about $\frac{1}{8}$th, the other $\frac{1}{30}$th of an inch in diameter. The cases, with their contents, are placed on a stove and brought up to the boiling point, (212°,) when the steam drives off all the atmospheric air. In order to prevent any air from re-entering through the openings before mentioned, a ring of gas flame is applied around them. For this purpose, the under surface of a ring or hoop burner is padded on the under surface with a ring of cotton or other soft material, which, being pressed down upon the case, prevents any air from passing under the burner, while the hollow dome of flame over the hole effectually prevents the entrance of atmospheric air through it. When the substances are sufficiently cooked, the holes are closed by soldering, the largest first, the heat being continued at the boiling point for some time afterwards, in order that, if any atmospheric air has not been expelled, it may be decomposed.

In some cases the burner is dispensed with, and a fluid bath, (as in Goldner's specification,) is employed; when as much of the air has been expelled as is possible, the holes are soldered up, and the heating continued from ten to thirty minutes longer, according to the size of the case.

The claim is, 1. To the mode of employing a burner for excluding the atmosphere, and for closing the openings of cases wherein animal and vegetable substances and liquids produced therefrom are to be preserved. 2. To the mode of preserving animal and vegetable matters in closed cases, by expelling as much air as possible by means of heat, and then closing the opening during the heating process, and continuing the heat after closing, for a time, in order to decompose the remaining atmospheric air. 3. To the application of the fluid bath as described.

ANTHONY TODD THOMSON, M. D., OF HINDE-STREET, MANCHESTER-SQUARE, *for an improved method of manufacturing calomel and corrosive sublimate.* Petty Bag Office, September 8, 1841.

The method herein patented consists in combining chlorine gas with the mercurial vapour. The apparatus employed consists of a glass, or other suitable vessel, set in brick-work, and communicating at one end with a large air-tight chamber, and at the other end, by means of a bent tube, with an alembic charged with a mixture of common salt, binoxide of manganese, and sulphuric acid, or of binoxide of manganese and muriatic acid. A quantity of mercury is placed in the glass vessel, and its temperature raised to between 350° and 660° Fahr., by means of an open fire beneath. As the chlorine gas is generated, it passes from the alembic, through the bent-tube, into the glass vessel, and there combining with the vapour of the mercury, forms either corrosive sublimate or calomel, according to the quantity of chlorine gas employed, which is found at the bottom of the air-tight chamber, and may be removed through a door after the operation is completed.

The claim is to the direct combination of the gas called chlorine with the metal called mercury or quicksilver, either in a state of vapour or otherwise, so as to form the compounds called corrosive sublimate and calomel, according to the proportions in which the vapours and materials are combined.

THOMAS JOSEPH DITCHBURN, OF ORCHARD-HOUSE, BLACKWALL, SHIP-BUILDER, *for certain improvements in ship-building, some*

*or all of which are applicable to steam-boats, and boats and vessels of all descriptions.* Enrolment Office, September 8, 1841.

These improvements consist in planking with wood upon frames of iron bars; the bars may be either angle iron bars, or T iron, the former being preferred. The framing of angle iron bars is constructed in the same way as the framing of iron ships or boats, and the bars are let into the inner planking: so that the inner and outer planking come together, and are secured by screw bolts and nuts. To secure the ends of the outer planking, short bars are affixed to the long bars or ribs by rivets, &c., and the end of one plank is fastened to the short bar, while the end of the other plank is fastened to the long bar. Hair felt is placed between the inner and outer planking, and the seams are caulked as usual.

To preserve the figure of the ship, when it is of considerable length, iron truss-plates are applied to the framing, at an angle of 45° to the vertical position of the bars or ribs. Suspension-plates are also employed for the same purpose, being let flush into the outer planking, and proceeding crossways of the truss-bars.

The suspension-plates at the stem and stern are preferred to be placed at an angle of 75° to the vertical position of the bars; and as they approach the midships, to assume an angle of 50°.

This mode of building applies only to large vessels, where great strength is required; for smaller vessels, the inside planking is omitted.

The claim is, 1. To the mode described of outer and inner planking with wood upon angle iron bars, whether such bars are single angle iron bars, or T iron bars. 2. To the mode of outer planking with wood upon angle iron bars, and secured by screw-bolt fastenings as described.

JOHN BAPTIST FRIED WILHELM HEIMANN, OF LUDGATE-HILL, MERCHANT. *for improvements in the manufacture of ropes and cables.* Enrolment Office, September 8, 1841.

These improvements relate to the manufacture of such wire ropes as are composed of six strands laid round a core, each strand being composed of six wires laid round a core, and consist, firstly, in the employment of swivels for preventing the twisting of the individual wires. These swivels are attached to a tackle-board at one end of the rope-walk, and one end of a wire attached to each swivel; the other ends of the wires are fastened to a hook at the end of an iron axis, which passes through the centre of a tackle-board at the other end of the rope-walk. A rotary motion is given to this axis by means of a crank-handle, in order to twist the wires round a core to form a strand.

Secondly, in an improved form of rest or support for retaining the separate wires, and the strands of wires, in a circular form, and at uniform distances from each other, whilst being laid. The single rest consists of an upright wooden stake, having three cross bars, at the extremities of which, and in the centre of the middle one, which is the largest, hooks or open rings are placed in a circle twenty inches in diameter, to receive the six wires and the core. When six strands are to be made at the same time, a combination of three rests is used, viz., a single, double, and treble rest, which together form six circles, each twenty inches in diameter, and so placed that each centre ring or hook is equidistant from the other centre rings, in a circle which is fifty-two inches in diameter.

Thirdly, in the application of tar, or other preservative material, with which the cores are saturated before laying them into strands or ropes, in order to prevent oxidation of the wires.

Fourthly, in a mode of combining machinery so as to form longer ropes than usual, which consists of an addition to the ordinary machinery of two framings, the one containing six drums placed round a circle; the other, one large drum. Six strands of the usual length are first formed, (the wires being left of different lengths,) and are wound on the six drums, being fastened firmly near their ends to the axis of each drum. Other wires are then joined to the ends of the first, their other ends being fastened to the swivels of a tackle-board, to which a rotary motion is given, and the usual process of making the strands is repeated, until the required length is obtained. Six strands being thus formed and wound upon the six drums, they are fastened at their outer ends to a hook in the centre of a tackle-board, and the rope laid as before, nearly up to the drums; it is then wound upon the large drum, and secured just above the unfinished part, which is then completed.

The claim is, 1. To the application of swivels, to prevent the individual wires from being twisted in themselves, whilst being laid into a strand. 2. To the improvements in the form of the rests or supports by which the separate wires and the strands of wires are retained in a circular form, and at equal distances from each other, whilst the strands and ropes are being laid. 3. To the application of preservative matters, by saturating the cores of hemp or other fibrous material before the wires are wound thereon in forming strands, and before the strands are wound thereon in forming ropes and cables. 4. To the mode of combining machinery for the manufacture of wire ropes of any required length.

THOMAS CLARK, PROFESSOR OF CHE-

MISTRY, IN MARISCHAL COLLEGE, UNIVERSITY OF ABERDEEN, *for a new mode of rendering certain waters, (the water of the Thames being amongst the number,) less impure and less hard, for the supply and use of manufactories, villages, towns, and cities.* Enrolment Office, September 8, 1841.

The waters to which this discovery is applicable may be distinguished by the following indications. 1. The water must indicate an alkaline action. 2. On boiling the water for two hours in a glass vessel, under arrangements which will allow the bulk of the steam to be condensed and returned back to the boiler, a powder should be deposited entirely, or almost entirely, soluble with effervescence in muriatic acid. 3. By such boiling, the water should be softened to an extent that is material for practical purposes.

The present invention consists in mixing lime-water with the water to be purified, in such proportions as to guard against any excess. The rule given for ascertaining these proportions is, to measure the alkalinity of both waters, and to use them in the inverse proportions of their respective degrees of alkalinity. Thus, if the alkalinity of the water to be purified is $12\frac{1}{2}$ degrees, and that of the lime-water 175 degrees; then, as the alkalinity of the lime-water is 14 times greater than that of the water to be purified, 1 measure of the former is to be added to 14 measures of the latter.

JOHN WILLIAM NEALE, OF WILLIAM-STREET, KENNINGTON, ENGINEER, AND JACQUES EDOUARD DUYCK, OF SWAN-STREET, OLD KENT ROAD, COMMISSION AGENT, *for certain improvements in the manufacture of vinegar, and in the apparatus employed therein.*—Enrolment Office, September 8, 1841.

These improvements consist in the manufacture of vinegar from beet-roots; these roots, after being thoroughly washed, are reduced to the state of pulp by rasping. A number of strong cloth bags are filled with this pulp and placed in a press with a board or hurdle between them, and subjected to a powerful pressure, till the whole of the saccharine juice is extracted. The juice, which will vary in strength from about 7° to 9° of the areometer, is to be reduced to 5° by the addition of water, and boiled; the liquid is then removed to the coolers. On the temperature falling to 60° Fahr., the wort is removed to the fermenting vat, and half-a-gallon of yeast added for every 100 gallons of wort.

When the fermentation is over, the liquor is removed to the acidifying vessel, which is a strong vat capable of holding 24,000 gallons; in its centre, at a short distance above the bottom, there is a perforated rose, communicating by a pipe with a blowing machine, A steam worm lies at the bottom of the vat, communicating with a boiler, and furnished with a stop-cock, the other end of the worm being open to the atmosphere. The vat is divided into several compartments by perforated diaphragms, and in the cover of the vat there is a valve opening upwards.

Two thousand gallons of vinegar are first let into the vat to serve as mother to an equal quantity of fermented wash, which is next introduced, with a little yeast, when acetous fermentation quickly ensues. Air is then forced in through the perforated rose, which in its passage through the perforated diaphragms enters into intimate contact with the liquor, imparting a portion of oxygen to it, and expelling the carbonic acid gas through the valve in the vat cover. When the temperature of the liquor falls below 70° Fahr. steam is admitted to the worm, so as to maintain the temperature constantly between 70° and 80.°

In a few days the liquid will be converted into vinegar, when 4000 gallons more of fermented wash are let into the vat, and the process continued until the whole 8,000 gallons become vinegar. This course is pursued until the vat contains 24,000 gallons of vinegar, when 8000 gallons are drawn off and clarified, and replaced with 8,000 gallons of fresh wash, and so on continuously.

The claim is, 1. To the improved process and apparatus for manufacturing vinegar from beet-roots.

2. The process and apparatus for effecting and maintaining the acetous fermentation, and all such modifications of the same, wherein the acetous fermentation is conducted by the combined operations of an air-forcing apparatus and steam-heat applied in pipes or vessels within the acidifying vessel, whether the process of conducting the acetous fermentation be applied to the making of vinegar from beet-roots, or any other substances.

3. To the application of an air-forcing apparatus in the manufacture of vinegar, or acetous acid, distinctly considered from the other part of the apparatus.

RICHARD LAWRENCE STURTEVANT, OF No. 22, CHURCH-STREET, BETHNAL GREEN, SOAP MANUFACTURER *for improvements in the manufacture of soap.*—Petty Bag Office, September 8, 1841.

These improvements consist in manufacturing hard soap at one operation in the ordinary boilers, without separation of lees, or precipitation of niger, which is effected by using some or all of the following ingredients, viz., cocoa-nut oil, palm oil, tallow oil, and potash lees. Also the muriates of soda and potash.

The specific gravity of the lees is measured by Beaumé's hydrometer, at a temperature of 62° Fahr.

The following is the mode of making white soap: 2,072lbs. of cocoa-nut oil, (in its raw state, or deprived of its rancidity in the manner hereafter noticed;) 168lbs. of olive oil, sweet oil, or tallow; 375 gals. of soda lees at 24°, and 60 gals. of potash lees at 20°, are boiled together in the following order:—The cocoa-nut, and other oil, or tallow, are first put into the copper, which may be heated by fire or steam; 10 gals. of the soda lees are then added, and the mixture allowed to boil; the remainder of the soda lees is added from time to time in similar quantities, the mixture being kept boiling. In about ten minutes after the whole of the soda lees have been put into the copper, about 84lbs. of muriate of soda or potash are slowly sprinkled over its surface, and the mixture boiled for half-an-hour, when the fire or steam is withdrawn, and the soap is finished, and is to be cleansed or framed, when cooled, in the usual way.

A hard soap for fulling, and such like purposes, is composed of the following ingredients, viz., 1,792lbs. of cocoa-nut oil; 336lbs. of tallow; 224lbs. of olive oil; 112lbs. of rape oil, or of colourless palm oil; 400 gals. of soda lees at 25°, and 80 gals. of potash lees at 20°.

All these ingredients being put into the copper, the heat is applied, and the operation conducted as above, except that the muriates of soda or potash are not used, but as soon as the soap is made, 2,240lbs. of grained, or curd soap, made upon the old plan, is added, and the mixture boiled until the two soaps are thoroughly incorporated.

To remove the rancidity of cocoa-nut oil, 10 cwt. of it is boiled in a wooden vessel by steam, with 3lbs of sulphuric acid, or 6lbs. of muriatic acid. Or the oil is boiled alone for a sufficient length of time in an iron pan, by means of a dry heat.

The claim is, 1. To the making of hard soap at a single operation, without separation or removal of lees, or precipitation of niger.

2. To the use of cocoa-nut oil, in conjunction with other materials, in the manner, and for the purposes described.

3. To the mode of depriving cocoa-nut oil of its rancid and unpleasant odour by the processes described.

4. To the use of potash lees for the purpose of improving the quality and appearance, and giving a greater tenacity to soap.

5. To the use of muriate of soda, and muriate of potash, for the purpose of giving greater tenacity and hardness to soap.

6. To the ascertainment with greater facility and accuracy of the quantities and proportions of alkaline lees requisite to be used with the other ingredients in the manufacture of soap.

7. To the mode of making a fulling soap, or soap for manufacturing purposes, in the manner described.

Andrew M'Nab, of Paisley, North Britain, Engineer, *for certain improvements in the manufacture of bricks.*—Enrolment Office, September 11, 1841.

Two openings are made in the bottom of the pug mill, through which the brick earth is alternately forced into moulds beneath by the inclined blades of the mill. A sliding frame beneath the bottom of the mill, contains two moulds, so arranged, that whilst one of them is under one of the openings in the bottom of the mill receiving the clay, the other is outside the mill delivering its brick. The bottom of each mould consists of a piston or plunger, which, when the mould has arrived outside the mill by the movement of the frame, forces the brick up out of the mould, when it is removed by the workman.

To give motion to the main-shaft and to the mould frame and pistons, a horizontal bevel-wheel is affixed on the main-shaft, which receives motion through another bevel-wheel from any convenient source; on the upper surface of the former wheel, a curved inclined plate is fixed, which is carried by the rotation of the wheel under an anti-friction roller on the lower end of the stem of each piston, which it raises. On the upper surface of this wheel a crank pin is also fixed, carrying an anti-friction roller, which, at certain parts of the rotation works against two projections on the mould frame, and moves it to and fro, bringing the moulds alternately under the opening in the bottom of the mill.

The claim is—1. To the mode of applying a sliding frame of moulds under a pug mill, with a bottom, in which are formed openings, to correspond with such moulds; through which openings the moulds are filled, by the revolution of the knives, or blades of the pug mill as described.

2. To the mode of moving a sliding frame of moulds, and working the pistons, or plungers of such moulds by the axis of the pug mill, passing through the sliding frame of moulds, and by means of the bevel cog-wheel, the inclined plane, and the crank pin.

## WHITELAW AND STIRRATT'S PATENT WATER-MILL.

Having seen several accounts from time to time of the patent Water Mill, invented by Mr. Whitelaw of Glasgow, we had the curiosity a few days ago, of visiting the Culcreuch Cotton Works, Stirlingshire, where one of the patent Water Machines has recently been erected. The Culcreuch works are six stories in height, nearly 200 feet long, and 38 feet wide: they contain above 20,000 mule spindles—several hundred throstle spindles—with other machinery requisite for such works. Hitherto, and for many years, the works were propelled by two huge water-wheels, upwards of 30 feet each in diameter, one 5 feet in breadth, the other 12 feet in breadth. These wheels made about four revolutions per minute; they were supposed equal to about 60-horse power, and were fitted up at an expense, perhaps, of not less than £2,000, whereas the Patent Machine now in their place is only about 9 feet in diameter, yet it is equal to 95-horse power, and gives sixty revolutions per minute, and the entire expense of fitting it up is only about £600! On looking at it revolving at the bottom of the pit in which the supply of water enters, the first impulse is that of astonishment, that such a machine, in the small compass, comparatively, in which it is placed, possesses such gigantic and unerring power. The machine itself resembles a large-bodied sea snake coiled up, and making its angry circumlocutory gyrations in a boiling surf, yet it is attended with the most complete safety to the vast work which it wields, and the persons of those connected with it.

We are convinced that this is one of the most remarkable improvements ever made in the application of water as a moving power.—*Scotch Reformer's Gazette.*

## LIST OF DESIGNS REGISTERED BETWEEN AUGUST 24TH AND SEPTEMBER 22ND.

| Date of Registration. 1841. | Number on the Register. | Registered Proprietors' Names. | Subject of Design. | Time for which protection is granted. |
|---|---|---|---|---|
| Aug. 23 | 791 | T. Wharton | Miniature frame back | 3 years. |
| 24 | 792 | E. H. Batwell | Stove | 3 |
| " | 793 | E. Heeley and Co. | Paper file | 3 |
| 26 | 794 | R. Rettie | Filter | 3 |
| " | 795 | T. Humphries | Carpet | 1 |
| " | 796 | O. Caldecott | Coffin plate | 3 |
| " | 797 | J. H. Drury, and W. H. Biggleston | Thrashing machine | 3 |
| 27 | 798 | S. Ackroyd | Fender | 3 |
| " | 799 | J. Hobson and Son | Scissors | 3 |
| 30 | 800 | J. and J. Walker | Gambroon | 1 |
| " | 801 | S. Ackroyd | Fender | 3 |
| " | 802 | A. Lapworth | Carpet | 1 |
| " | 803 | H. A. Sanders | Envelope | 1 |
| " | 804 | W. Blurton | Cheese shelf | 1 |
| " | 805 | S. Sutcliffe | Tray | 1 |
| 31 | 806 | Nuttall and Holden | Button | 3 |
| Sept. 1 | 807 | J. Wilkie | Plough mould board | 3 |
| 2 | 808,10 | J. and T. Edwards | Plate | 1 |
| " | 811 | Ditto | Dish | 1 |
| 3 | 812 | J. Hall | Provision case knife | 3 |
| 6 | 813 | The Colebrook Dale Company | Fender | 3 |
| " | 814 | Ditto | Stove | 3 |
| " | 815 | Ditto | Fender | 3 |
| " | 816 | Kitcley and Fawcett | Carpet | 1 |
| 7 | 817 | T. Johnson | Plough-share | 3 |
| 8 | 818 | S. Ackroyd. | Stove | 3 |
| " | 819 | J. Rodg[illegible]d So | Sci. | 3 |
| 9 | 820 | T. Nicholson, and H. E. Hoole. | Stove | 3 |
| " | 821 | T. Walker | Stove | 3 |
| " | 822 | The Colebrookdale Company | Fender | 3 |
| " | 823 | S. Ackroyd | Stove | 3 |
| " | 824 | W. Hancock, Jun. | Steel pen renovator | 3 |
| 10 | 825,6 | Mc Michaels and Grierson | Carpet | 1 |
| " | 827 | J. Dockree | Gas-burner | 1 |
| " | 828,30 | J. Newcomb, Son, and Jones | Carpet | 1 |
| " | 831 | C. A. Jaquin | Waistcoat band | 3 |
| " | 832 | J. and T. Edwards | Plate | 1 |
| 13 | 833 | T. Horn | Guard cleaner for mincing machines | 3 |
| " | 834 | J. Cemm and A. Hooper | Toast-rack | 3 |
| " | 835 | J. Yates | Fender | 3 |
| " | 836,7 | Lea and Co. | Carpet | 1 |
| 14 | 838 | S. Coote | Corn stand | 3 |
| " | 839 | Ditto | Drain | 3 |
| " | 840 | S. Mordan and Co. | Pencil | 3 |
| 16 | 841 | J. Jones | Lamp | 3 |
| 20 | 842 | J. and J. Walker | Cantoon | 1 |
| " | 843 | S. Ackroyd | Fender | 3 |
| 21 | 844 | F. J. H. Muller. | Shawl | 1 |
| " | 845 | G. R. Elkington | Card | 1 |
| 22 | 846 | J. and G. H. Humphries | Carpet | 1 |

## SUPPLEMENTARY ACCOUNT OF THE USE OF AUXILIARY STEAM POWER ON BOARD THE "EARL OF HARDWICKE," AND THE "VERNON" INDIAMEN.

BY SAMUEL SEAWARD, M. INST. C. E.

The advantage of the employment of auxiliary steam power, on board large sailing ships, had been shown by the author in a former paper, (p. 63) it was now further exemplified by the result of the recent voyages of the *Ea of Hardwicke*, and the *Vernon*.

The former vessel, of 1000 tons burthen, with one engine of 30-horse power, effected the voyage from Portsmouth to Calcutta in 110 days, a much longer time than usual; but still with an advantage of 29 days over the *Scotia*, a fine vessel of 800 tons, which sailed one week before the *Hardwicke*, and arrived 22 days after her. During the voyage, the *Hardwicke* used her engine 364 hours, and was propelled by it 946 knots; an average of nearly three knots per hour; while in a calm, with the ship steady, she made five knots per hour. The total consumption of fuel was 90 tons.

The *Vernon*, which sailed one month after the *Hardwicke*, made her passage to Calcutta in 97 days; passed the *Scotia*, and arrived seven days before her, gaining 42 days upon her during the voyage. The *Vernon's* consumption of fuel was also 90 tons, but the copy of her log not being arrived, the number of hours during which steam was used could not be ascertained.

The *India* steam-ship, of 800 tons burthen, with engines of 300-horse power, had not arrived at Calcutta, although she had been out 109 days, so that the *Vernon*, with only auxiliary steam power, had already gained 12 days upon her.

The comparison between the advantages of these two vessels, in point of expense, is then fully entered into, and shows a saving of £3733, in favour of the *Vernon*, on a single voyage, while she gained at least 12 days upon the *India* in point of time.

This communication is accompanied by a copy of the log of the *Earl of Hardwicke*, and by letters from the captains of that ship and the *Vernon*, speaking in the highest terms of the assistance of the steam power in certain parts of the voyage.—*Trans. Inst. of Civ. Eng.*

## LIST OF ENGLISH PATENTS GRANTED BETWEEN THE 24TH OF AUGUST AND 22ND OF SEPTEMBER, 1841.

Richard Whitaker, of Cambridge, machinist, for improvements in cutting the edges of books, and paper for other purposes; and in impressing ornaments, letters, and figures on the binding of books and on other surfaces. September 4; six months.

Theophile Antoine Willhelme Count of Hompesch, of Mivart's Hotel, Brook-street, Middlesex, for improvements in obtaining oils and other products from bituminous matters, and in purifying or rectifying oils obtained from such matters. September 4; six months.

John Boot, of Quandron, Leicester, lace glove manufacturer, and John King, of Ilenor, lace-maker, for certain improvements in machinery or apparatus for manufacturing or producing figured or ornamented fabrics in warp and bobbin-net lace machines. September 4; six months.

John Grafton, of Cambridge, civil engineer, for an improved method of manufacturing gas. September 4; two months.

Michael Coupland, of Pond-yard, Southwark, mill-wright and engineer, for improvements in furnaces. September 4; six months.

George Wildes, of Coleman-street, merchant, for improvements in the manufacture of white lead. (Being a communication.) September 4; six months.

William Hill Darker, senior, and William Hill Darker, junior, both of Lambeth, engineers, and William Wood, of Wilton, carpet manufacturer, for certain improvements in looms for weaving. September 4; six months.

Louis Lachenal, of Titchfield-street, Soho, mechanic, and Antoine Vieyres, of No. 40, Pall-mall, watch maker, for improvements in machinery for cutting cork. September 4; six months.

John Jukes, of Lewisham, gentleman, for improvements in furnaces or fire-places. September 6; six months.

Pierre Pelletan, of St. Paul's Church-yard, professor of medicine, for improvements in propelling fluids and vessels. September 6; six months.

Joseph Drew, the younger, of Saint Peter's Port, for an improved method of cutting and rolling lozenges, and also of cutting gun-wads, wafers, and all other similar substances, by means of a certain machine designed by him, and constructed by divers metals and woods. September 6; six months.

Luke Herbert, of No. 12, Staple's-inn, London, for certain improvements in apparatus and metals used in the manufacture of gas for illumination; also improvements in the apparatus for burning the same. (Being a communication.) September 8; six months.

Richard Else, of Gray's-inn, esquire, for certain improvements in machinery or apparatus for forcing and raising water and other fluids. September 8; six months.

William Fairbairn, of Millwall, Poplar, engineer, for certain improvements in the construction and arrangement of steam engines. September 8; six months.

Joseph Cooke Grant, of Stamford, ironmonger and agricultural implement maker, for improvements in horse-rakes and hoes. September 8; six months.

Nathaniel Card, of Manchester, candle-wick-maker, for certain improvements in the manufacture of wicks for candles, lamps, or other similar purposes, and in the apparatus connected therewith. September 8; six months.

James Thorburn, of Manchester, machinist, for certain improvements in machinery for producing knitted fabrics. September 8; six months.

Miles Berry, of Chancery-lane, civil engineer, for a new or improved method or means of, and apparatus for, cleansing typographical characters or forms of type, after being used in printing. (Being a communication.) September 8; six months.

Oglethorpe Wakelin Barratt, of Birmingham, metal-gilder, for certain improvements in the precipitation or deposition of metals. September 8; six months.

Joseph Garnett, of Haslingden, dyer, and John Mason, of Rochdale, machine-maker, for certain improvements in machinery or apparatus employed in the manufacture of yarns and cloth, and are also in possession of certain improvements applicable to the same. (Being partly a communication.) September 8; six months.

Edward Loos de Schelcstadt, engineer and chemist, and Etienne Sterlingne, tanner, of Regent's-square, in the county of Middlesex, for certain new or improved machinery or apparatus and process for tanning skins or hides, and preparing or operating upon vegetable and other substances. September 8; six months.

George Mannering, of Dover, plumber, and Henry Harrison, of Ashford, plumber, for certain improvements in the means of raising water and other liquids. September 8; six months.

Alphonse René Le Mire de Normandy, of Redcross-square, Cripplegate, doctor of medicine, for certain improvements in the manufacture of soap. September 8; six months.

William Crosskill, of Beverley, iron-founder and engineer, for improvements in machinery for rolling and crushing land, and in machinery to be used in the culture of land. September 9; six months.

William Hickling Bennett, of Ravensbourne Wood-mills, Deptford, gentleman, for improvements in machinery for cutting wood, and in apparatus connected therewith, part of which may be applied to other purposes. September 9; six months.

Charles Louis Stanislas Baron Heurteloup, of Albany-street, Regent's-park, for an improved manufacture of continuous priming for, and improved mechanism for the application of the same to, certain descriptions of fire-arms. September 9; six months.

Conrad Frederick Stoltmeyer, of Golden-terrace, Barnsbury-road, Islington, merchant, for certain improvements in obtaining and applying motive power by means of winds and waves, for propelling vessels on water, and driving other machinery. September 17; six months.

William Newton, of Chancery-lane, civil engineer, for improved machinery for manufacturing felts or felted cloths. September 20; six months.

Joseph Hulme, of Manchester, engineer, for certain improvements in machinery or apparatus for grinding, sharpening, or setting the teeth of cards, or other similar apparatus employed for carding or operating upon cotton, wool, or other fibrous substances. September 20; six months.

Thomas Huckvale, of Over Norton, Oxford, farmer, for improvements in horse-hoes, and in apparatus for treating and dressing turnips, to preserve them from insects, and promote their growth. September 20; six months.

Alfred Elam, of Huddersfield, surgical instrument maker, for improvements in apparatus or instruments for the relief and cure of procedencia and prolapsûs uteri. September 20; six months.

Luke Hebert, of Birmingham, for improvements in machinery for fulling woollen cloth (Being a communication.) September 20; six months.

William Charlton Forster, of Bartholomew Close, Gent., for a material, or compound of material, not hitherto so used for preventing damp rising in walls, and for freeing walls from damp, which material, or compound of material, can be applied to other purposes. September 20; six months.

Francois Marie Agathe Dez Maurel, of Newington Terrace, Surrey, for an improved Buckle. September 20; six months. (Being a communication.)

George Shillibeer, of Milton-street, Euston Square, carriage builder, for improvements in the construction of hearses, mourning and other carriages. September 20; six months.

William Bush, of Deptford, engineer, for improvements in the means of, and in the apparatus for, building and working under water. September 21; six months.

Comte Melano de Calcina, of Nassau-street, Soho, for improvements in paving or covering roads, and other ways, or surfaces. Sept. 21; six months.

Edward Emanuel Perkins, of Weston Hill, Norwood, Gent., for improvements in the manufacture of soap. September 21; six months.

John Duncan, of Great George-street, Westminster, Gent., for improvements in machinery for driving piles. September 21; six months.

Henry Bessemer, of Baxted House, Saint Pancras, engineer, and Charles Louis Schonberg, of Sidmouth Place, Gray's Inn Lane Road, artist, for improvements in the manufacture of certain glass. September 23; six months.

George Scott, of Louth, miller, for certain improvements in flour mills. September 23; six months.

James Whitelaw, engineer, of Glasgow, and James Stirratt, manufacturer, of Paisley, Renfrew, for improvements in rotary machines to be worked by water. September 23; six months.

## NOTES AND NOTICES.

*Steam Navigation of the Nile.*—A new iron steamer, called the *Cairo*, has just been launched from the building-yard of Messrs. Ditchburn and Mare, which is intended to convey passengers and luggage to and from various places on the banks of the Nile. She is propelled by two oscillating engines of 16-horse power each, made by Messrs. Penn and Sons, of Greenwich, and her draught of water is only two feet. It is expected that she will realize an average speed of 15 miles an hour.

*Captain Smith's Paddle-wheel Life-boats*, (described in *Mech. Mag.*, No. 843 ) are, we are happy to observe, coming rapidly into general use. Seven steamers are already at sea equipped with them, and seventeen others are now fitting. Captain Peacock, the commander of the *Peru* steam-packet, writes from the Pacific, that "it was only by means of one of these boats he was able to communicate, through a heavy surf, with shore at Ilo; no other boat would live, and though his paddle-boat was only 25 feet long, he was yet able to land 11 passengers and 7 tons of goods, in the night time, with all the facility of a first-rate Massulah boat."

*Thames Steamers.*—The Watermen's Steam Packet Company have contracted with Messrs. Ditchburn and Co. and Messrs. Penn and Son, for five new vessels of the same size and description as the *Cairo*, (mentioned in the preceding notice,) to be in readiness by Easter Monday.

*Blaxland's Propeller.*—The correspondent who favoured us with the notice of this new propeller, inserted in No. 944, informs us that he was mistaken in stating that it had been actually applied to the *Swiftsure*—an error into which he was betrayed "from misconceiving the scope of a letter he had received on the subject." An accurate trial of the speed of the *Swiftsure* was made on the 18th of August last, preparatory to the removal of her paddle-wheels, and the substitution of Mr. Blaxland's propeller; but the substitution has not yet actually taken place.

*Coffee Drinkers*, who study at once to please the palate and save the pocket, should make a trial of a new preparation which has recently made its appearance, under the quaint name of *Eupool*. It is an extract of chiccory, prepared by a peculiar process, patented by a Mr. Handford, and when mixed with coffee, in the proportion of about two to three, yields a beverage greatly superior in richness and flavour to any made from coffee alone, not excepting even the best Mocha or Bourbon.

LONDON: Edited, Printed, and Published by J. C. Robertson, at the Mechanics' Magazine Office, No. 166, Fleet-street.—Sold by W. and A. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; and W. C. Campbell and Co., Hamburgh.

# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

SATURDAY, OCTOBER 2, 1841. [Price 6d.

Edited, Printed and Published by J. C. Robertson, No. 166, Fleet-street.

## ROBINSON'S PATENT SUGAR CANE MILLS.

Fig. 1.

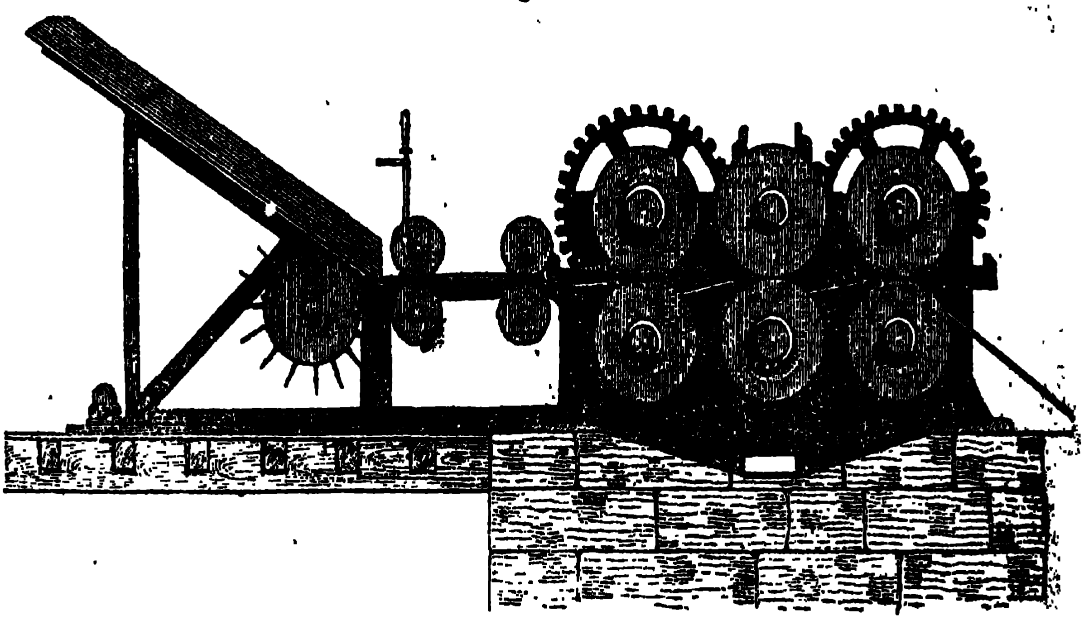
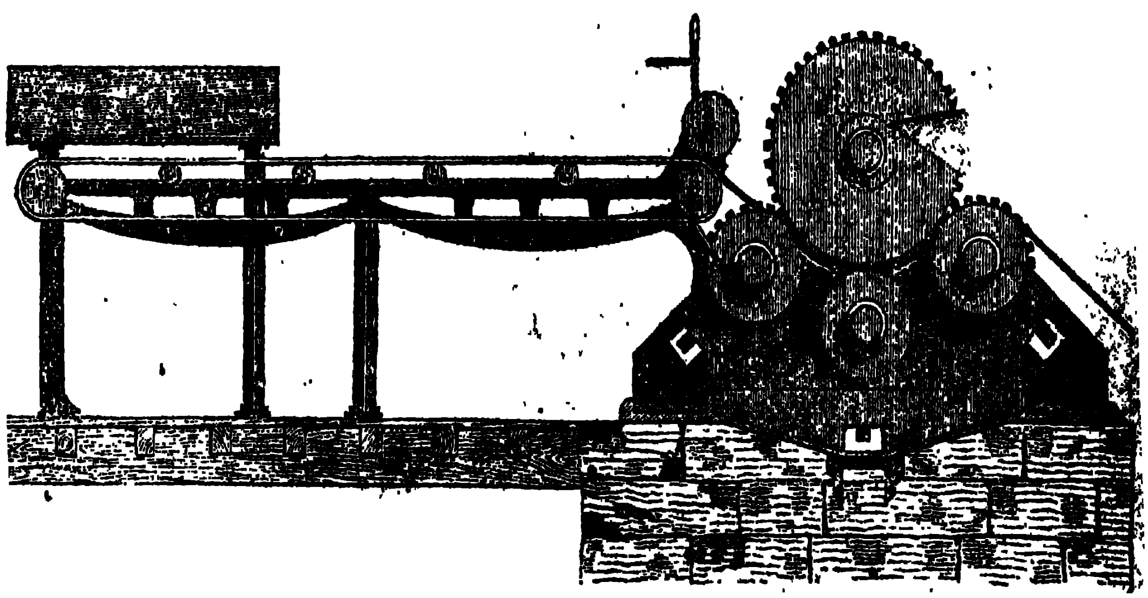


Fig. 2.



## ROBINSON'S PATENT SUGAR MILLS.

In a Memoir recently presented to the Academy of Sciences at Paris, by M. G. Péligot, it was demonstrated that the constituent parts of the Sugar-cane, of the species called Otaheite, are 90 per cent. of juice, and 10 per cent. of fibrous or woody matter.

At any period, researches, the object of which would be to determine with exactness the different quantities or proportions of the component parts of the Sugar-cane, would have commanded in a special manner the attention of that part of the public interested in such inquiry; but at the present time they acquire a new degree of interest by the circumstances in which we are placed.

M. Péligot therefore deserves commendation for having undertaken these researches, and the more so, as he has been able to rectify some very material errors in the important art of extracting sugar from the cane. The authors who had hitherto studied the analysis of the Sugar-cane juice considered it as water holding in solution sugar, gum, albumina, mucilaginous matter, a kind of soapy substance, acids, and divers salts; according to their notions it was a liquid of a very compound nature, and from thence they inferred that it was so difficult to extract the sugar from it. M. Péligot, on the contrary, proves that the juice of the Sugar-cane, when filtered, is composed simply of four parts of water and one of crystallizable sugar; that it is nothing but sweetened or sugared water, or at least that the other saline or organic substances which are found therein do not exceed 17 parts in 1000 by weight.

By the sugar mills ordinarily employed to express the juice, the quantity obtained only averages from 45 to 55 per cent. It is true, that some canes may contain less than the above proportion of juice, and that in some few cases better results may be obtained from the mills; but it is admitted on all hands, that the general result is very much below what it ought to be. A large proportion of the saccharine juice remains in the canes after the present operation, which is lost to the manufacturer, or only goes to increase the combustible character of the canes when used as fuel.

Nor is the deficiency of production the only defect of the present sugar mills; those persons who have had any experience in the colonial sugar manufactures, know full well the loss and annoyance which continually arise from the frequent breakage of the machinery.

To our readers it may be observed, that owing to the carelessness of the parties employed, and the imperfection of the machinery, breakage is a common accident, and one which, from the very inadequate means of repair to be met with in the colonies, frequently causes the loss of the "crop" or entire year's labour and expenditure of the planter.

With a view to remedy both these defects, an arrangement of machinery is proposed to be substituted for that heretofore used, the joint invention of a planter of twenty years' experience, and present eminence, and of an engineer of talent and application, resident in a British sugar colony during the last five years. The details have been perfected here, and the invention has been patented in England,* France, and their dependencies and plantations abroad, and is in process of being secured by patent in all the sugar-producing countries and colonies.

Fig. 1, of the engravings on our front page, is a side elevation of this patent Sugar Cane Mill, No. 1, and feed apparatus complete, with one side frame removed for distinctness. In this arrangement it will be seen that the canes are subjected to three pressures, by which the whole, or nearly the whole, of the juice is expected to be expressed; its extraction being still farther assisted by the application of a jet of boiling water, or of steam, being thrown upon the canes previous to their entering between the third pair of rollers.

Fig. 2 is a side elevation of a patent Sugar Cane Mill, No. 2, with its endless band for feeding the canes to the rollers. (One side frame being again omitted.)

These engravings, although representing but imperfectly two modifications of the machines, will give a better idea of them than any lengthened description. It will be at once perceived by persons

* Vide abstract of specification of page 446 of our 931st Number.

having an acquaintance with the subject, that there is nothing complex or experimental in the new mill, and that it is adapted to operate more effectively than the common one.

The distinguishing peculiarities of the new mill, and the advantages claimed for it by its ingenious patentees are as follows:—

1st. That the canes are fed into the mill, or, in other words, put between the pressing cylinders by an apparatus or machine, attached to and worked by the mill itself, by means of which they are supplied regularly, evenly, and lengthwise; instead of being fed in by the hands of the attendant blacks intermittingly and in unstratified bunches, now too little and then too much, which has the double disadvantage of hindering the action of the cylinders upon a portion of the canes passing through, and of severely straining the machinery.

2nd. The canes undergo three distinct and consecutive pressings, at each of which the juice expressed is separated from them by being thrown *back*, while in the common mill the canes are subjected to but two pressings, at the first of which the expressed juice is thrown *forwards* with the canes, and but very partially separated from them, leaving nearly the whole to be separated at the second pressing, which, as shown above, fails in obtaining the juice to a great extent.

3rd. The pressing cylinders or rolls are tied or held to each other by *malleable iron* straps or bars, which relieve the *cast iron* side-frames from the great strain they are subject to in mills of the usual construction. Should any of these straps beak, they are easily and promptly replaced. B.

## THE CRANK.—REPLY OF M. TO R. W. T.

Sir,—There will not be much difficulty in satisfying your correspondent R. W. T., (see p. 100,) that my experiments described in a former paper are not foreign to the point at issue, in the controversy relative to the loss of power in the crank.

The work performed by the motion of the two weights of 56 and 28 pounds moving over a space of 6 inches, is represented by the number 224, the power expended being 50 lbs. Moving over a space of 4 inches, it would be represented by 200. The work performed in the experiment when 37½ lbs. was in motion is represented by the number 149. The space passed over being 4 inches, and the power expended being 200, as before, the discrepancy between these numbers your correspondent does not think extraordinary, but asks with great simplicity —did I expect an increase of power in the crank, in the latter part of its action, in the ratio of 28 to 37, because in the former part I diminished its task in the ratio of 56 to 37? I assure him I expected no increase of power in the crank from these causes, but I did expect that the increased momentum given to the smaller weight of the two, was no loss of power caused by the combined effects of friction, and that the shifting leverage, would have caused it to pass over 6 inches, so as to have the same amount of work represented by the number 224, which was done in the former experiment. This reasoning will be made more satisfactory by the following experiment. I removed the cross-bar from the table on which these experiments were performed, and put the weight of 37 lbs. on the board *k*, and I attached the cord which passed from this board *k* along the table and down the pulley, to one end of a short lever of the third order, fixed under the table: I put the weight of 50 lbs. on this lever, in such a position, that a motion of 4 inches given to this weight or power would cause the end of this lever, to which the line aforesaid was attached, to move 6 inches, by drawing back the board *k*, with the weight of 37 lbs. thereon, a few inches. As before, this board and weight was moved over a space of 6 inches; in other words, the board and weight, when put in motion by means of a shifting leverage, would not pass over more than 4 inches, although the same power was made use of and expended; but when the action on it was constant, it moved 6 inches, or showed a gain of 50 per cent. in power.

Now, as no loss of power, in the opinion of your correspondent, took place when the body moved over 4 inches, in the first instance, and yet with the same expenditure of power I made it move over 6 inches, I think I am entitled to a reward from the perpetual motion seekers, for having demonstrated that a given

power can be considerably increased mechanically: but I leave all the merit and profit of the discovery to your correspondent.

Your correspondent has detected an error in my experiments, and it is a satisfaction to me to find that he can sufficiently understand my description, to enable him to do so; and that it is only when he finds a difficulty in refuting my arguments or facts, that he finds it more convenient to appear not to understand me.

Although it is an elementary principle in mechanics, that increase of surface, the weight remaining the same, will not cause increase of friction, nevertheless, such is not the case in these experiments; for when I put the second board on the top of the board *k*, I should have removed, as much as possible, all friction between the upper side of the board *k* and this upper board. I accordingly performed the experiment a second time, and removed as much as possible, (by means of smooth surfaces and friction rollers,) of the friction between these boards, leaving the friction between the table and the board *k* the same as before, (the table having the cross-bar and all the arrangements as in the experiments described in my first letter.) I put the weight of 37¼ lbs. on the upper board, and putting 50 lbs. in the scale under the table, the board *k* was moved over a space of 3 inches. It will be readily conceived, that the want of momentum in the board *k* was the cause it would not move the 4 inches, and I was now anxious to remove, also, any effects from the action of momentum in the power made use of; and the result of my experiments in doing so will satisfy not only your correspondent, R. W., I am inclined to think, but all other unbelievers in the loss of power in the crank, that the loss actually takes place, without the necessity of showing what becomes of this loss—an inquiry which seems to be a favourite with some gentlemen, but which I do not see any necessity of pursuing on the present occasion.

I request the particular attention of your correspondent to the following experiment; and also of those persons who are endeavouring to account for the superiority of the Cornish engines in every way but the only feasible manner it is likely be discovered.

I removed the lever and scale from under the table, and, in place of making use of the weight or power of 50 lbs, I contrived a spring and lever of such a force as would be equivalent to that weight; and I tested the accuracy of its strength by making the weights of 56lbs. and 28 lbs. be moved over the spaces of 2 inches and 4 inches respectively, when the cross-bar was made use of, as in the first experiments described. I now removed the two weights of 56 lbs. and 28 lbs, and placing the second board on the board *k*, making use of the friction-rollers, and putting the weight of 37¼ lbs. on that board, I brought the board *k* two inches back from the line marked on the table, and found that it would not move more than 2 inches up to the time the cross-bar came to the stop. There was no momentum, either from the weight or from the power, to cause it to move past the line marked on the table. I now removed the cross-bar, and arranged the table as in the experiments described where the shifting leverage was not required; and fastening the spring and lever to the short lever before described, in a similar manner as I applied the 50lbs. weight to that lever, and I found that the board *k* was moved over a space of 6 inches. I considered this experiment quite conclusive; and I will defy your correspondent, or any other person, to controvert or to demonstrate that either the reasoning or facts given are erroneous.

There has been an attempt made to account for the superiority of the Cornish engines by Mr. Parkes, and others, on the idea that steam has a certain degree of momentum, and it is contended that this may, to some extent, be a cause of their success; but the experiment I have just described demonstrates, in the most satisfactory manner, that the want of momentum is a serious cause of loss of power in the crank, in place of its being the cause of power in the other engines.

There is a loss of power in crank engines, caused (if none of the other causes mentioned interfered) by the uniform motion of the fly-wheel, which I believe has never been noticed, but I have not space at present to go into the particulars; and I think I have given your correspondent sufficient to do, in leaving him to dispose of the experiments I have related.

I am, Sir, &c.,
M.

P.S.—An Aberdeen correspondent, who signs himself "A Mechanic," at p. 439, has inadvertently thrown a light on this subject, which is not unworthy of notice: not that his arguments are novel, or conclusive in the matter, but that they exemplify in a striking manner the arguments made use of by other writers; and particularly that writer in the *Encyclopædia*, whom you, Mr. Editor, were one time so much enamoured of, and other persons who make nice distinctions between loss of power and loss of effect, without showing where the distinction applies. This writer describes two experiments made with a steam-engine, one with a crank, the other without one, and he admits the crank engine did not do more than one half the work which the other engine performed; but, says your correspondent, "inasmuch as one engine must have consumed double the quantity of steam, in consequence of consuming it in the proportion of the speed of the piston-rod, it cannot be said that one engine had any superiority over the other." Now, both these engines must have been working up to their full power, and in both experiments consuming equal quantities of coal, otherwise the experiment was not a fair one; but it must be assumed this was the case, else why report it without stating the whole truth? Then if there be no variation in the quantities of coal consumed, what is it to the practical, or even to the theoretical mechanist, (except as a matter of curiosity,) whether there be more steam consumed by one engine than by the other? And is not the decided superiority of the engine without the crank thereby established? But is not the same fact demonstrated every day before our eyes, on a magnificent scale, by the Cornwall engines? Although the arguments made use of by this writer may appear, in the point of view here taken, so very ridiculous, they are not one bit more so than the arguments made use of as alluded to above by the other writers; but the mathematicians have thrown something like a spell over people, which prevents them occasionally from making use of their common sense in inquiries of this nature. The very able critique in your publication, p. 147, on Mr. Russell's work on the steam-engine shows that he dreaded to compromise (I might almost say) his professional character by touching on the subject, in one of decidedly the most important points connected with this wonderful engine. The mathematician has in this instance, as I said before his class have often done, thrown a spell over some of our most intelligent philosophers. Had not Drummond questioned the demonstrations of that prince of mathematicians, (which he may justly be called, when we consider the age in which he lived,) Sir Isaac Newton, and relied on his own sagacity and powers of research, we would not probably at this day have at our command that beautiful and useful instrument the achromatic telescope—a fact which should of itself induce us to be cautious how we place implicit confidence in writers, when their opinions, or demonstrations if you will, clash with the works of nature.

I am, Sir, &c.,

M.

## THE NEW "THEORY OF THE UNIVERSE."

Sir,—I hope that you will have the goodness to insert the following observation on heat and cold, relative to the "New Theory of the Universe."—All bodies are constituted to maintain suitable quantities of positive heat, and of positive cold, and to admit of variations of these portions to a prescribed limit. Any variation beyond this limit, either in quantity or portion, produces a destruction, or a chemical change of the body. Thus the vaporous exhalation of water, meeting with an increased proportion of cold at the surface becomes ice. Water with cold in excess, on collision with heat becomes ice, while in collision with cold, with heat in excess, it becomes steam. Is it surprising that the collision of the two powers of nature, which thus occurs, should rend the strongest substances? It appears absurd to talk of cold heat, yet one thing may have all its natural heat, and be, in fact, cold as to that which has naturally more. (The term *sweet* acid, is, I believe, not new to philosophers.) There may exist a great deal of positive heat in a body without its being in activity, and we know that cold can be preserved from the admission of heat. The sensation of heat is an effect, not a cause.

Your obedient servant,

E. A. M.

September 18, 1841.

## ANNUITIES.

Sir,—In order more fully to test the accuracy of the theorem for finding the value of $p$ which I gave in No. 921 of the Magazine, I have calculated the two following tables, the first of which is deduced from the true theorem, $p = \frac{1}{a}\left(\frac{b}{R} + \frac{c}{R^2} + \frac{d}{R^3} + \&c.\right)$ and the second from the approximate formula above mentioned; both tables are calculated to the nearest farthing. The term of assurance is for seven years, the rate of interest 3 per cent., and the probabilities of the durations of life, according to the *Carlisle* tables. P. is the present worth of £1 annuity depending on the ages, 10, 20, 30, &c., for seven years, supposing the first payment at the time of purchasing, and $p$ the value of the same, supposing the first payment is made at the end of the year; S. P. and A. P. denote the single and annual payments for assuring £100 for seven years.

### TABLE I.

Computed from the true theorem $p = \frac{1}{a}\left(\frac{b}{R} + \frac{c}{R^2} + \frac{d}{R^3} + \&c.\right)$

| Ages. | P. | | | $p$. | | | S. P. | | | A. P. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ | s. | d. | £ | s. | d. | £ | s. | d. | £ | s. | d. |
| 10 | 6 | 6 | 6¼ | 6 | 2 | 1½ | 3 | 6 | 0 | 0 | 10 | 5¼ |
| 20 | 6 | 5 | 8¾ | 6 | 0 | 1½ | 4 | 6 | 10 | 0 | 13 | 9¾ |
| 30 | 6 | 4 | 7¾ | 5 | 19 | 9½ | 6 | 3 | 4½ | 0 | 19 | 9½ |
| 40 | 6 | 3 | 3¾ | 5 | 18 | 0¾ | 8 | 10 | 7¾ | 1 | 7 | 8¼ |
| 50 | 6 | 2 | 11 | 5 | 17 | 5¾ | 9 | 10 | 7½ | 1 | 11 | 0¾ |
| 60 | 5 | 15 | 8 | 5 | 8 | 0¾ | 21 | 6 | 1¼ | 3 | 13 | 7¾ |

### TABLE II.

Computed from the approximate theorem.

| Ages. | P. | | | $p$. | | | S. P. | | | A. P. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ | s. | d. | £ | s. | d. | £ | s. | d. | £ | s. | d. |
| 10 | 6 | 6 | 6 | 6 | 2 | 1¾ | 3 | 6 | 0¼ | 0 | 10 | 5¼ |
| 20 | 6 | 5 | 8¾ | 6 | 0 | 1½ | 4 | 6 | 10 | 0 | 13 | 9¾ |
| 30 | 6 | 4 | 8 | 5 | 19 | 9½ | 6 | 3 | 4½ | 0 | 19 | 9½ |
| 40 | 6 | 3 | 4 | 5 | 18 | 0½ | 8 | 10 | 7¾ | 1 | 7 | 8¼ |
| 50 | 6 | 2 | 11¼ | 5 | 17 | 5½ | 9 | 10 | 6¼ | 1 | 11 | 0½ |
| 60 | 5 | 15 | 8¾ | 5 | 8 | 1¼ | 21 | 6 | 0 | 3 | 13 | 7½ |

It appears from the above two Tables, that the greatest error by the approximate theorem is in the single premium for age 60, and that only amounts to 1¼$d$. in a sum of £21 6$s$. 1¼$d$. Now in the Carlisle Tables, the decrements of life are more irregular than those of the Northampton, or indeed than most other tables of the duration of life. Hence we may safely assert, that for a period of seven years, the approximate theorem will give the values of $p$, P, &c. sufficiently near the truth, whatever tables of probabilities

may form the basis of calculation. But, further, let $b'$, $c'$, $d'$, &c. be the number living at the end of $n, n+1, n+2, n+3$, &c. years; then the present worth of £1 per annum for $m$ years more, will be

$$p' = \frac{1}{a}\left(\frac{b'}{R^{n+1}} + \frac{c'}{R^{n+2}} + \frac{d}{R^{n+3}} + \&c.\right) = \frac{1}{a R^n}\left(\frac{b'}{R} + \frac{c'}{R^2} + \frac{d'}{R^3} + \&c.\right)$$

Let D′ be the average number that die annually after the period $n$, for a term of $m$ years more than will,

$$p' = \frac{b'\left(R^{m+1}+1\right) - \left(R^m+R\right) - D'\left(R^m - R\right) - (m-1).(R-1)\Big)^m}{a R^{n+m} (R-1)^2}$$

*Example.* — Required the present value of £1 annuity depending on the life of a person aged 20, for 14 years; data, Carlisle Tables; interest, 3 per cent.

Calculating the value of $p$ from the true theorem—

$\frac{1}{a}\left(\frac{b}{R} + \frac{c}{R^2} + \frac{d}{R^3} + \&c.\right)$ it will be found to be £10·71167; also the value of $p$ computed by the approximate theorem (see No. 921) for seven years, is £6·06095, and by the above approximate theorem, the reversionary value of $p'$ for the remaining seven years will be found to be £1·65112. Hence the present value for 14 years is 6·06095 + 1·65112 = £10·71507, differing from the true by the small fraction ·0004, or only ⅓d of a farthing.

The calculation of $p$ by the true theorem requires no less than 15 long divisions, but by the approximate theorems (dividing the given period into two terms) only six short multiplications and two divisions are required. The terms $R^{m+1}$, $R^m$, $R^{n+m}$ &c., are found at once in tables showing the sum in which £1 principal will increase at compound interest for any number of years.

I am, Sir, yours, &c.

GEORGE SCOTT.

21, New Church-street, Grove Road.

## SMOKE NUISANCE.

Sir,—Your columns being always open to receive any useful suggestion, I trust the following hints (which were originally communicated to the *Manchester and Salford Advertiser*,) may not be found entirely uncalled for or useless.

I would propose that the public authorities, in every considerable town where steam engines and chemical works of any description are established, should adopt some such code of regulations for obtaining information respecting them, as that now subjoined, viz.:—

To distinguish two classes of nuisances arising from smoke and vapours: 1st, steam engines alone. 2nd, chemical furnaces of every description.

I. Steam Engines.

1st, Power of engine or engines, and whether high or low pressure.

2nd, Number of boiler furnaces.

3rd, Whether fired by machinery or by hand.

4th, Probable consumption of coal or slack per week, month, or quarter.

5th, Whether any plan is, or has been used to prevent the smoke.

6th, Whether such plan succeeds.

7th, If abandoned, for what reason.

II. Chemical and other works.

1st, Steam engine power, and whether high or low pressure.

2nd, Number of boiler furnaces for the engine; and whether the boilers are also used for steaming.

3rd, Number and nature of all other boilers, pans, &c., and whether heated by steam or fuel.

4th, Number and nature of all other furnaces, distinguishing those which give off smoke from those which supply smoke or vapour along with acid, sulphurous, or other noxious fumes.

5th, Smiths', coking, or any open fires.

6th, Amount of consumption of coke, coal, or slack per week, month or quarter, distinguishing what is used for

the engine, from that used for other fires.

7th, Whether any, and what means have been taken to prevent the escape of smoke, and with what success.

8th, The same information in regard to the methods adopted to suppress the evolution of poisonous acid vapours.

Leaving these suggestions to be improved and acted upon for public benefit,

I remain, Sir, your obedient servant,

FUMO.

Mosley-street, Manchester, Sept. 1, 1840.

## ELECTRO-MAGNETIC ENGINES. — NEW SYSTEM OF ACTION SUGGESTED.

Sir,—Considering the principle and constructions of electro-magnetic engines, it became a question whether the power obtained is used in the best manner, and to the best effect; in other words, whether the place of rotating magnets may not be supplied by some better arrangement.

It would seem that force exerts itself naturally in straight lines only; and when forced from that straight line much friction and loss of power ensues. Thus steam issues from any opening in a straight line, or even if passed through a tube bent to an arc of a circle, it still issues from the mouth in a straight line. Steam engines may be divided into three great classes differing in effectiveness. First in order stands the Cornish engine, in which the motion is almost entirely in straight lines; next comes the crank engine, in which the motion is communicated to the piston in a straight line; last of all comes the rotative engine, which has never yet been found so available as either of the former, notwithstanding the ingenuity and talent spent upon it.

This train of thought led me to consider whether an arrangement could not be made in the electro-magnetic engine, on the principle of the reciprocating steam-engine. The result was the formation of a plan entirely new to myself, and the merits of which I leave your readers to decide upon. I have commenced a small model, upon which I purpose to experiment, and of which I will send you a drawing, together with the results of such experiments.

I propose that the magnet—be a straight bar of iron, round which the wire from the battery is to be coiled as usual. Two pieces of iron are to be fixed to a frame capable of moving freely backwards and forwards, the pieces of iron or alternators being exactly opposite the ends of the magnet, and the distance between them being equal to the length of the magnet, and length of stroke added together. The frame will turn a fly-wheel, by means of a connecting rod and crank, and upon the axis of the fly will be an eccentric, which will move the inversor, and reverse the current. Suppose now the negative pole of the magnet to be to the right, and the positive pole to the left, the connexion with the battery having been made; the alternator and frame will now move to the right, turning in its progress the fly-wheel, shaft, and eccentric, which, when the stroke is completed, will reverse the current by means of the inversor. The poles being now reversed, the frame will now move back into its first position, and the current being again reversed, the motion will continue.

Experiment alone can test the value of this arrangement, and I have been induced to send this communication thus early, in order that those of your readers who may have it in their power, and think it worth their trouble, may test it more fully; feeling in my own mind that self interest should never intrude itself as an obstacle to the furtherance of objects so vast and important to every one, and which indeed surpass in their magnitude our highest and most sanguine thoughts.

Yours, &c.

W. H.

St. John-street Road.

## PILBROW'S CONDENSING CYLINDER ENGINE.—MR. PILBROW IN REPLY TO MR. CHEVERTON.

Sir,—Mr. Cheverton's opening remarks on the sanguine temperament and delusions of *schemers* are just in their general application to them, but as I have confidence enough to class myself among the useful *inventors*, I beg I may not be ranked among the former. It is true Mr. Cheverton denies the direct application of his observations to me, but he blows them at me,

by a side wind, as it were, and would have your readers to consider that I am, after all, but one of those who delude themselves and the public. "It is a pity," he says, "that the enthusiasm of invention should have led either him, or Mr. Boyman, to advance the extravagant pretensions of being able to augment the duty done by the steam engine to double, and even treble its present amount." I will leave Mr. Boyman to answer for himself; but as my own reputation for sound views in the scientific world may be affected by these observations, I beg to reply to them.

My reading has taught me that if deductions are logically sound in themselves, before you can find fault with the result you must prove erroneous the facts from which they are drawn. I have well investigated, I believe, the principles laid down in my pamphlet, so that notwithstanding the charge of "enthusiasm, and extravagant pretensions," I repeat here what Mr. Boyman has stated in effect at pp. 54, and 97, and verbatim at p. 102:—

"That this saving, derived from other causes, is independent of clothing, or the use of expansive steam, and cannot be diminished thereby. That when these are carried out to their extreme limit in rotative engines, the saving is *merely* two-thirds in duty, *if Mr. Watt's practice is the best, or if not the best, double the duty at the lowest, on any calculation that can be founded on scientific investigation.*"

An engine of 50-horse power has been ordered on my plan, which will set the question at rest; yet, as I cannot, perhaps, get it built sooner than four months, I invite every discussion on the theory and principles on which it is founded, for it has been justly observed that "theory is the general that directs; practice, that executes." A few remarks therefore, if you please, on these points.

Strange is it, indeed, that a writer should charge me with "enthusiasm, and extravagant pretensions," when, instead of disproving my facts, Mr. Cheverton, unawares to himself, admits their truth. After correctly describing the action of the Cornish lifting engine, he says, "It is, in my opinion, on this point *alone*," namely, "the pause, and sufficient time for evacuation and condensation, that the superiority of those engines over what I think are very injudiciously called rotative engines, depends;* for the management of the fire, the construction of the boiler, the economising of caloric, and the advantage of expansion, *are the same in that county for both classes of engines.*"

I beg your readers will observe the importance of this admission, and well-known fact, and how satisfactorily it confirms my theory, that my engine will double the duty of the average of crank engines. Compare the extreme best performance of these engines in Cornwall, with the same of the single lifting engine, for what has been done once, can be done again. By Lean's Reports, (the last I have is for August, 1841, from which I extract,) the best crank engine is doing 70,908,981lbs. raised one foot high, and none, I believe, has ever done better. Though a *single* engine, and making 8·86 nine feet strokes per minute, therefore travelling at a speed of only 119·4 feet per minute, instead of the usual rate of 220 feet, this is only about $\frac{7}{12}$ths of 123,300,593lbs., the duty of the Wheal Vor Borlase's engine, in September, 1840, which duty has been exceeded since by 3,000,000. The first is a 32 inches cylinder; the latter is an 80 inches cylinder, with a stroke of 10 feet, and makes usually 5·67 strokes a minute. Something should be allowed for the greater advantage of the larger cylinder; but the small superiority of duty from this cause, can, in no degree, affect the *broad principle.* Now the Cornish crank engines only make about 8 or 9 single strokes per minute, and thus gain more time for evacuation of the cylinder, than the marine, or other crank engines, whose strokes are, say upon an average, 25 or 50 evacuations per minute; and yet, under precisely the same circumstances as enumerated by Mr. Cheverton, except *one*, the pause of evacuation, the Cornish crank engines do only $\frac{7}{12}$ths of the duty of the lifting engines. For this differ-

* I agree with Mr. Cheverton in the general misnomer, and shall call them for the future, crank engines.

ence in effect there is *only one cause not* in operation in the crank, as in the lifting engine; *all other causes are* the same, and this *one cause is* sufficient to account for the difference in effect. I have fully calculated this difference at p. 77 of my pamphlet, and pointed out the erroneous theory of percussion, erroneous at least, so far as relates to "such extraordinary power, so much beyond *what is due to the steam admitted into the cylinder*," which I was the first to detect. It will be seen too, at p. 24, that high-pressure steam had been used expansively at 33lbs. on the square inch, in marine engines, without a corresponding effect. Why? Because there is no time in these engines for evacuation of the cylinder before the stroke begins.

But let me further call Mr. Cheverton's attentive consideration to "Scalpel's" paper, in No. 927, p. 378, and which you, Sir, discriminately referred Mr. Russell to. Independent of, though precisely the same as my theory, it confirms it too strongly for me not to desire to avail myself of his views, though I have not invented my engine from them. That paper closely investigates the performance of the present, and Mr. Watt's crank engines, with the view to show, as it seems to me, first, that there is no better performance now, than in Mr. Watt's time, except what is due to clothing, and the expansion of steam, and which, without burning more fuel, Mr. Watt might have obtained. Secondly, that there must, therefore, be the same loss now in the present crank engines as in the former ones. "Scalpel" then shows this loss was 3½lbs. on the average, and brings these facts to bear with irresistible force, I think, to prove, that one cause of the inferior duty of crank to lifting engines, is the loss from an imperfect cylinder exhaustion, namely, the difference between the cylinder and condenser vacua. As I have gone over the same ground, and to precisely the same sources for my information as "Scalpel," to all the authorities named in his paper, and use them in support of my engine, *we* cannot differ in our *facts*. The question then is, are the facts correct; and if so, does my engine really effect the object, by saving this admitted loss in the crank engine?

Now when Mr. Cheverton charges me with "extravagant pretensions," because I say that I can double the duty, he should have remembered that the facts from which I draw my deductions are, right or wrong, those of Mr. Watt, not mine; that they are the result of those careful experiments referred to in my pamphlet, taken with the best engine of our greatest engineer, under his own eye, in the presence of Mr. Rennie; that they are recorded by Mr. Farey in one of the best authorities, and most esteemed works on the steam-engine; and lastly, as I have before observed, that their truth is distinctly admitted in their result, by Mr. Cheverton himself, in his discussion of the difference in duty between the Cornish lifting, and the Cornish crank engines. Where, then, is it an "extravagant pretension" to take data like these for my guide? When the facts themselves are doubted, I shall be ready to discuss their accuracy; at present, I have only to show that my engine will save the loss they show.

Mr. Cheverton says, "They," Mr. Boyman and myself, "should have asked themselves whether, in the present day, such a thing is probable, or even possible, especially as their improvement contemplates merely more advantageous mechanical arrangements, and not an increased development of power with reference to fuel, in which direction alone, any material increase in the efficiency of the engine, has in late years been obtained, or since the time of Watt was ever likely to be effected."

Observing that the improvements, good or bad, originated solely with myself, I need scarcely point out how unphilosophical and unscientific would be the process for an investigator to ask so fallible an oracle as himself, if an extension of nature were possible? Did Mr. Watt ask himself if it were possible to save ¾ths of the fuel of Newcomen's engine? Had he been content with doing so, we may be assured he had never effected the saving, and benefited so greatly the world. Collecting as many facts as were open to the public, (and I believe few, if any, can be pointed out that are unknown to me); not satisfied alone with the facts of the duty of Cornish

engines, but making accurate inquiries in writing of Cornish engineers, of their action, to determine if the cause inferred, namely, the pause for complete cylinder exhaustion really did exist; finding a perfect harmony in cause and effect, and that *both* were absent in the crank engines, I came to the conclusion, that there really *was* a great difference in the duty of the two classes of engines. Facts and experience have ever guided me, not my own answers to my own questions; they are better than opinions. It was only by uniting practical experience with strict deductions that Mr. Watt could have arrived at his felicitous thought of a separate condenser. He first discovered the cause of the loss, and then by these "merely mechanical arrangements," which Mr. Cheverton thinks so lightly of, saved the loss. "Mere mechanical arrangements" and combinations, are all that nature has left man to do to carry out her mysteries. Clothing, slow combustion, smoke consuming, the separate condenser, best form of boiler, expansion gear, my condensing cylinder, all are but "mere mechanical arrangements" to obtain greater results. To put more calorific properties into fuel, or elastic power into steam, than nature has done, forms certainly no part of *my* pretensions. All I profess to do is, by a "mere mechanical arrangement," to save and get the effect, in the crank engine, of that steam which is lost in them, but which is not lost in the lifting engine. This I shall effect by my engine, and double the duty, if the facts on which it is founded be correct.—"Man, the servant and interpreter of nature, understands, and *reduces to practice, just so much as he has actually experienced of nature's laws; more he can neither know nor achieve.*"—BACON'S NOV. ORG.

There are some other parts of Mr. Cheverton's paper that I beg to remark on. I claim a greater extreme of expansion because, though open to all, it cannot be used by any but in my engine, beyond that limit, the extreme benefit of which I have given to the present engines, and from which limit alone, I claim any advantage. I get a better extreme vacuum of 1lb. under my condenser piston, and get also the difference between the present cylinder and condenser vacua, say 2¼lbs.; thus with 3¼lbs. gained in less resistance, it is clear, I think, that I can reduce my steam lower than can be done with these resistances, else, with the same sized cylinder, I should give a power greater than is required; I consider, therefore, that I only fairly claim what I alone can use.

I never remember to have met with any one, before Mr. Cheverton, who doubted the accuracy of mathematics; if the data and principles be sound that the mathematician has to work upon, his deductions will be sound also; it is not the mathematician who so often errs as the philosopher.

"It is" (not) "singular it did not occur to Mr. Boyman that Mr. Pilbrow had not provided any room for the steam to expand in, &c." I have, I hope, passed that period of invention that would lead me to expand either in a cold chamber, or in a second cylinder. The steam, after being expanded to its extreme limit in the hot cylinder, enters the condensing cylinder, and meets with no space but what it makes by giving motion to its piston. What is between the two pistons is simply as a rod of communication for the transmission of pressure, the effect of which is precisely the same as if there were but one piston and one cylinder, with steam on one side, and a nearly perfect vacuum to *begin* with on the other, a vacuum superior to what *can* be got *in the condenser* of the present engine at the end of the stroke. Nor does Mr. Cheverton, I think, see the object and action of my engine, when he says that my arrangement allows no longer time for the evacuation of the cylinder than the present. Such is not the design of my engine. Practice may determine that *all* the used steam is not to leave the cylinder, nor the injection water enter the condensing cylinder, until ⅘ths of the stroke. It will, during this time, be merely the medium of transmitting pressure, and then, being nearly *all present at once in the condensing cylinder*, ample time will be afforded to reduce it instantaneously, giving the nearly perfect vacuum for the next stroke to begin with. It was with reference to this, my remark at p. 58, that I was anxious it should not be confounded with the

*expansion* engine Woolf or Hornblower.

Mr. Cheverton's idea of two single-stroke crank engines was very early tried, and abandoned, by Mr. Watt. I believe it was the first crank engine. The causes are obvious.

The orifices are now large enough for the steam to flow from the boiler on to the piston of the present engines, to develop all its power; and large enough for it to flow into the condenser quicker than it can be condensed. I alter not these proportions. Why, then, should I not have, at least, the advantages of the present engine in this respect? Very soon is the equilibrium obtained in the present engine, and the same pressure found, by the barometer gauge, in the present condenser, as in the cylinder, but which cannot be given out for the want of a piston. During that portion of time, however minute, when, on its immediate reversal, the piston begins against a plenum, and the steam cannot find that *instantaneous annihilation* which is now in vain sought for, I shall have the resistance to the steam piston given out to the condenser piston.

I have, I believe, well considered the various schemes of condensation for getting a better mean cylinder exhaustion, which I well knew would start up as soon as public attention was drawn to the loss by my invention. These I am prepared to combat when advanced; and to show that what may be gained one way, will be lost another. Thus, I think I shall have "the exclusive advantage" questioned by Mr. Cheverton; because I contend, that no system of condensation can produce the same good vacuum to begin each stroke with, as I can obtain in my engine without a corresponding loss some other way.

Every means will, of course, be taken to show how small is the amount of loss from imperfect cylinder exhaustion. Many will deny altogether that there is any to save. Diagrams will be produced in evidence of the fact; diagrams arising from the attempt, not to support their *bona fide* authority by corresponding diminution of fuel, but from a good diagram *being the only object sought for*. The only honest, and the only real criterion of duty is that so judiciously produced in Cornwall—consumption of fuel. I caution, then, the public against the reception of extraordinary diagrams, without this test. Let them bear in mind that Mr. Watt found, under those general conditions which would insure most duty, 2¼ lbs. to 3¼ lbs. loss on the square inch. What he did, and what is done now, are, of course, two different things; and from the present practice alone, not so much from Mr. Watt's, should be, and is, my data taken; from that which can deceive no one, with proper investigation—the consumption of fuel. I will not, then, go by the diagrams of the present day, unless this test is produced; then I will admit their soundness.

The great want in inventors, (independent of their not tracing effects and principles to their right causes, and of taking a narrow view of their design, confined to only one particular part of a whole,) is, the want of knowledge of what has been done before. Hence the numerous entire revivals, or parts of old attempts, of what have failed. No one has questioned the complete originality of the object I propose to obtain, nor the originality of the means of accomplishing it. And as originality has ever been considered the highest merit and test of excellence, let the public feel *inclined*, at least, to believe that, after three parts of a century have passed without any essential improvement in the crank engine, the time has arrived when every saving of fuel is called for; when commerce, and speed in communication for the long voyage, have rendered it more important than it would have been twenty years ago. Let them investigate with severity, but with encouragement; as hoping it may perform, not wishing it may not realize, the hopes of the inventor. May no second Addison damn it with his faint praise, and "let it pass" down the stream of oblivion "for what it is worth."

Modesty gains respect, we learn at school; but I fear, Sir, in the present iron age, it gains nothing more, and that unless an individual, who is supported by the consciousness of his strength, applies his own shoulder to the wheel, no one else will do so for him. But as I am not insensible to the delusions of self-complacency, and how

soon another may see what we cannot ourselves, I beg sincerely to thank your correspondents for their papers, which have led me to a firmer conviction of the superiority of my engine to Mr. Watt's; and I beg also to invite further investigation of it.

With many thanks to you, Sir, for your constant indulgence,

I remain,

Yours respectfully,

JAMES PILBROW.

Tottenham-green,
Sept. 20, 1841.

PILBROW'S CONDENSING CYLINDER ENGINE — REMARKS ON MR. BOYMAN'S PAMPHLET, AND MR. PILBROW'S APPENDIX.

Sir,—As it may be deemed churlish to withhold my opinion respecting Mr. Pilbrow's engine, whose request I did not meet with until September, I will endeavour to assign the reason why I place no reliance on Mr. Boyman's calculations, and submit others, founded I am ready to admit, more on theoretical than practical observations.

The patent is intended to remove a well known and definite defect in steam engines, viz., the difference between cylinder and present condenser pressure, an object that is supposed to have been effected in one district, by a very simple arrangement in pumping engines, that is inapplicable to rotative engines, but which object Mr. Pilbrow proposes to effect by different means for the latter class of engines.

I have had already occasion to advert to a part of this subject, in objecting to Scalpel's views, some of whose statements in the second series of deductions seem to me to be at variance with each other. Mr. Boyman has adopted a similar line of argument, and has attempted to show that a difference of 3½ or 4lbs. exists between the mean cylinder and condenser vacuum, which, together with resistances of 1 5lbs. of uncondensed steam, produce a mean vacuum resistance of 5 or 5½lbs. per square inch on the piston.

Pambour's statement is, that some indicator experiments give the mean resistances about 4lbs.; that 1½lbs. is due to the condensed resistance, and that 2½lbs. is the difference between cylinder and condenser; and as I believe the most eminent manufacturers of steam engines would guarantee that such resistances should not exceed 4lbs. at the piston, and agree to perform the average duty according to Cornish expressions, per bushel of coal expended of 8lbs. of coal per H. P. per hour, I would recommend Mr. Pilbrow not to trust too much to speculative comparisons of Watt's engines from short trials at the Albion mills, and perhaps elsewhere, (on which, if I am not mistaken, Farey's arguments are founded,) with the average performance of the Mediterranean Mail steamboats at 8lbs. of coal per H. P. per hour, working with boilers evaporating salt water instead of fresh. I refer to these vessels, as the report was brought forward before expansion seems to have been heard of among steamers; and it seemed founded on Admiralty logs.

In the *Mech. Mag.* for May there is a report of observations made by Mr. Joshua Field, at a meeting of the Institution of Civil Engineers, from which it appears that the engines of the Great Western

were estimated at 400 H. P.
sq. in. lbs.
$\frac{4242 \times 7 \times 2}{33{\cdot}000}$ scarcely 400 H. P. } but as 7lbs., and a fraction per sq. inch was used, giving full 400 H. P.

with a consumption of 26 tons per 24 hours: this amounts to 6½lbs. per H. P. per hour. I have seen a similar account of the Gorgon or Cyclop engines, to which I cannot at present refer. These are points of extreme importance to Mr. Pilbrow; I merely call his attention to them, observing, that they are performances of large engines by first-rate makers; and consequently furnish no foundation for an average. (If the H. P. of the Great Western was taken at 450, as has been usually stated, her performance would be under 6lbs. per hour per H. P.)*

Judging from Cornish results of the value of long and short trials, as given in the *Mech. Mag.*, it seems in the ratio of 120 millions for 6 hours to 80 for a month's work; no stoppages or allow-

* See, on the real power of the Great Western, the concluding notice of Mr. Russell's book, in our present number.—ED. *Mech. Mag.*

ances are, I believe, ever made in the reports; while, care alone, in the attention to the fires, extra grease, and other minutiæ, even without coal manœuvring, might account for a large portion of the difference. I conceive a very considerable addition ought to be made to Watt's trials at the Albion mills and in others—as much perhaps as 25 per cent. on the coal used per H. P. per hour. The Herland engine, in Cornwall, is stated to have performed 27 millions per bushel, (Welsh coal), but in the Phil. Trans. of 1827 and 1830, an investigation proved that the average performance of twenty-three of Watt's engines in 1798 was only 17½; but it is stated, on Watt's authority, who introduced the present system of engine duty, that 19½ millions was the average in 1793.

Now, $\frac{19 \cdot 500 \cdot 000}{1 \cdot 980 \cdot 000} = 10$ H. P. per hour from the duty, $\frac{84}{10}$ would be 8,4lbs. per H. P. had the best Newcastle coal been employed. Swansea coal, which is heavier, was doubtless used, and it may be taken as a set-off for the differences of duty and horse power.

*Are the advocates of the superiority of Watt's earlier engines prepared to prove that his rotative engines consumed less coal on the average than his pumping engines?*

The Lancashire and Glasgow consumption of 10lbs. per H. P. per hour in factory engines falls to 8lbs. when allowances are made for the inferiority of the coal of those districts. Moreover, Mr. Armstrong has shown that factory owners work their engines like post-horses, beyond their power,—conditions not favourable to a low consumption of coal. Steam-boats too, like Lancashire engines, are worked up to their power, besides using salt water in their boilers; while in rivers and for short voyages, the motto is, "Speed at any consumption of coal."

I shall now address myself more particularly to the observations in the pamphlet, including, of course, those by Mr. Pilbrow himself. I would first assure him, that having personally experienced all the difficulties mentioned by the editor of the *Mech. Mag.* in the use of the indicator, and others not referred to, I do not wish to press my arguments too far, but would recommend extreme precaution, and further experiments on good engines, under his own superintendence, as the basis of future calculations, conceiving that he has to deal with an actual grievance, and not a shadow.

Page 78.—In explanation of the action of the Cornish engine, it is stated, "the return of the re-pumping stroke is effected by the weight of the rods, which are sometimes assisted by additional weights." That such a case might occur in a new mine lifting water by means of a plunger cannot be denied; but the common story is (see Parkes *passim*), that the weight of the rods so much exceeds that of the water column, that a portion of it is balanced, and such balance obviously aids the steam-acting stroke.

The accuracy of this statement must be settled, before it is necessary to advert to the observations respecting the possibility of the steam in the cylinder at the end of the stroke being compressed equal to or above the boiler pressure. This seems as original an idea as Parkes' percussion, and, if proved, not favourable to the latter.

No explanation is given by what means the engine is induced to make the advantageous pause afterwards alluded to, as occurring between the strokes, for perfect condensation, with steam on the piston as high as that which can be supplied by the boilers. For instance, taking the load at 10 or 12lbs. per square inch of water on the piston, we should have a pressure counteracting this amount, plus, friction, &c. of 45lbs. per square inch, and yet a state of rest.

Page 80.—Mr. Boyman states, "that Mr. Parkes did not find a deficiency of, or absence of power in the cylinders as shown by the indicator diagram." This seems a mistake, as Mr. Parkes found that the indicator diagram of Wheal Towan engine did show a deficiency of power. Holmbush and Fowey Consols engines do not appear to have been so tried.

Page 90.—An argument is here made use of, of a character similar to those respecting latent heat, &c., by which Mr. Palmer once convinced himself and some other engineers of the impossibility of the production of a *greater power* from steam than 54,000,000. The next page, showing how the water from a *duty* of double that amount had been weighed, appears an untoward fact. Mr. Palmer's error was simple enough; he forgot to take into consideration the circumstance that steam can exert power during the act of

expansion, when cut off, as well as when running out from a boiler. It is only the amount of such power that here requires revision.

Page 52.—Mr. Boyman uses the words "full pressure steam in cylinder per square inch," and adds, "extreme condenser vacuum," from which $\frac{1}{3}$rd for friction, is deducted according to Tredgold's formula. But the latter is entirely framed for boiler pressures, as was correctly stated in Mr. Pilbrow's letter. Tredgold's adoption of a variable basis of calculation seems to have rendered worthless the large mass of valuable information in his work. The revision (if the working cylinder was not inserted in mistake) will not prove, I conceive, so favourable to Mr. Pilbrow as that of the expansion calculations. I was induced to expose the error in consequence of the remarkable pretensions to scientific accuracy and investigation contained in the pamphlet. An error of judgment in this instance seems less excusable than carelessness, and is sufficient to raise a suspicion of the accuracy of other calculations and assertions.

My observation, that practice would soon test the merits of Mr. Pilbrow's engine, should it find as warm supporters in deeds as in words, will scarcely bear the interpretation, that "the engine is too highly spoken of in Mr. Boyman's pamphlet;" yet, after the above remarks, my opinions may be expressed in another proverb, that the chickens have been counted before they were hatched; still, if ever they are hatched to expectation, the praise will not be too high.

I would now ask Mr. Pilbrow to point out the error of the rule I employed in obtaining 15lbs. as the mean pressure of 17$\frac{3}{4}$lbs. of steam, cut off at $\frac{1}{2}$ stroke.

The best mode of performing short arithmetical calculations gives a higher result than he estimates; taking the centre pressure of the expansive portion, we have $\frac{17{\cdot}75}{1{\cdot}5} = 11{\cdot}83$ and $\frac{17{\cdot}75 + 11{\cdot}83}{2} = 14{\cdot}78$.

In giving the subjoined estimate of the greatest possible saving that can be effected by this engine, I have omitted any reference to mechanical questions, as I conceived the drawing was only intended as a sketch for explanation; and many points have already been adverted to by others. With a steam power in the cylinder of 15, the friction, including resistances of all kinds, cannot, I think, be taken higher than 3lbs. I have already given an opinion, that 4lbs. is about the mean cylinder vacuum. Now, in Mr. Pilbrow's engine, I should take the condenser pressure for 96°; at about 1, the cylinder is warmer, and for this cause, at least $\frac{3}{4}$ of a lb. must be allowed, if not more. Hence:—

Watt's engines $15-3+4=8$lbs.

Pilbrow's do. $\overline{15-3+1,+,75}=10{,}25$lb.

provided the arrangements, &c., work as anticipated.

I had almost forgotten to mention the circumstance that a variation of duty from 22,000,000 to 101,000,000 may be found in the Sept. Report of Cornish engines, fifty-four millions being the average performance of fifty-one engines, all of which have the *pause* between the strokes for condensation. Had this been the principal cause of the higher duty, the results, I fancy, ought to have been more equal.

Objecting to Mr. Pilbrow's views of the principal cause of such improvement, and to the deduction obtained from the short trials of Watt's earlier rotative engines, on which so much stress has been recently laid, as an average performance, I can only repeat my recommendation of a cautious inquiry relative to the performances of modern engines.

I am, Sir,

Your obedient servant,

S.

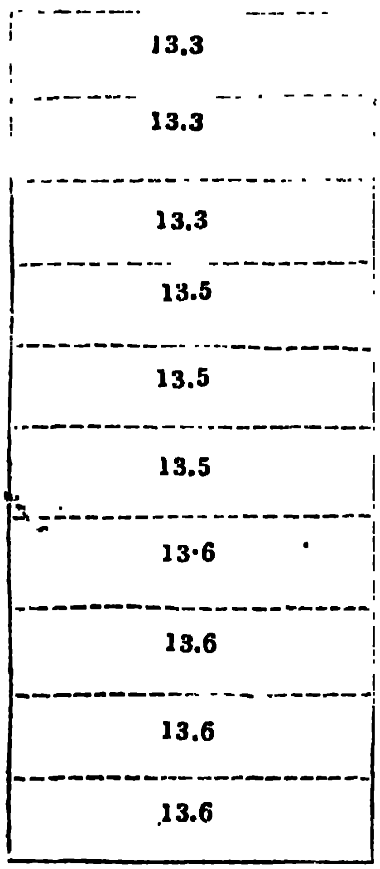
MR. PILBROW'S CONDENSING CYLINDER STEAM-ENGINE.

Sir,—I inclose you two diagrams which I hope will let Mr. Pilbrow see that his engine will not be very superior (if it will be at all) to the common form of those now used, with air-pump and condenser used separately.

Fig. 1, is a diagram taken with Mr. M'Naught's Indicator, by Mr. M'Naught himself, and I can vouch for the accuracy of it. A, L, is the atmospheric line. It was taken from the upper side of the cylinder. I have no doubt that it would be better on the under

side, as it would have a more direct communication with the condenser. However, as it is, it shows a vacuum in the cylinder, of 13·48lbs., that was when the engine was newly started, but I heard it had improved since.

Fig. 1. L




A 13.48 lbs.

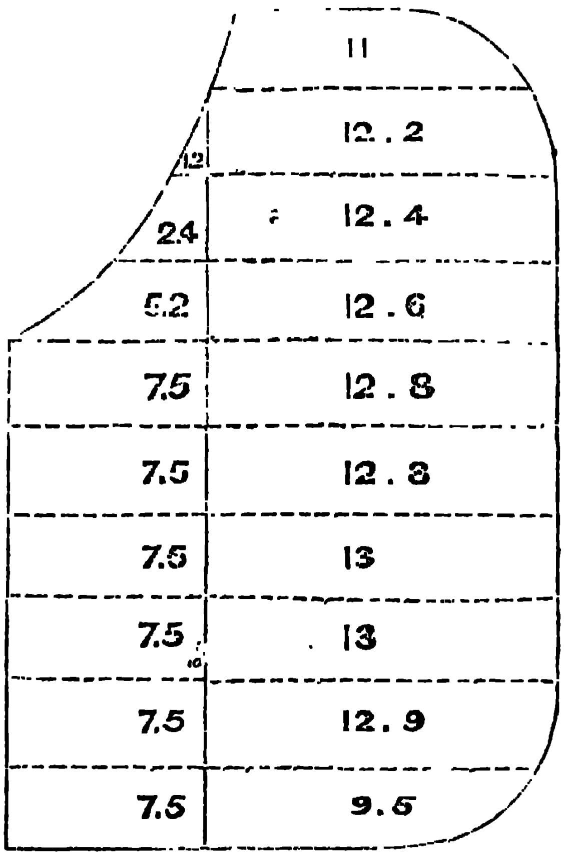
It may be proper to mention that the engine is used for driving the silk-mills, Edinburgh, and was made by the late Claud, Girdwood, and Co., Glasgow.

Fig. 2, is taken from the *Commodore* steam-boat, on the Glasgow and Liverpool station, made by Robert Napier, Glasgow. A, L, is the atmospheric line; the spaces on the left side of the line, A, L, denote the proportions of steam above the atmosphere. It shows a vacuum of 12·21lbs. in the cylinder, carrying 7·5lbs. of steam, but being shut off at $\frac{6}{10}$ths of the stroke, this reduces it on an average to 6·28lbs.

Now Mr. Pilbrow cannot mean to say that he will, by his engine add 4lbs. of vacuum in either of these cases; I think he will have to add some weight to the atmosphere before he will do that.

In my opinion, the old system of having a condenser and air-pump is preferable to Pilbrow's. The air-pump is objected to by many, as they think it requires a great deal of power to work it: some think about $\frac{1}{5}$th of the whole engine. A very little thought will convince a person that it takes very little power off the engine.

Fig. 2.




6.28

The bucket works in a vacuum equal to the condenser; the weight of water, (which for a 40-horse engine is only 126lbs. each stroke,) bucket, cross-head, and rods, to lift which, is all the engine has to do once every revolution. The friction is very little unless the bucket be very firmly packed, for which there is little use; I think $\frac{1}{12}$th is sufficient.

By giving this a place in your useful Magazine, it will perhaps be the means of preventing Mr. Pilbrow from wasting his time and money needlessly, and you will oblige

Yours, &c.,

A. M.

Glasgow, September, 14, 1841.

Fig. .

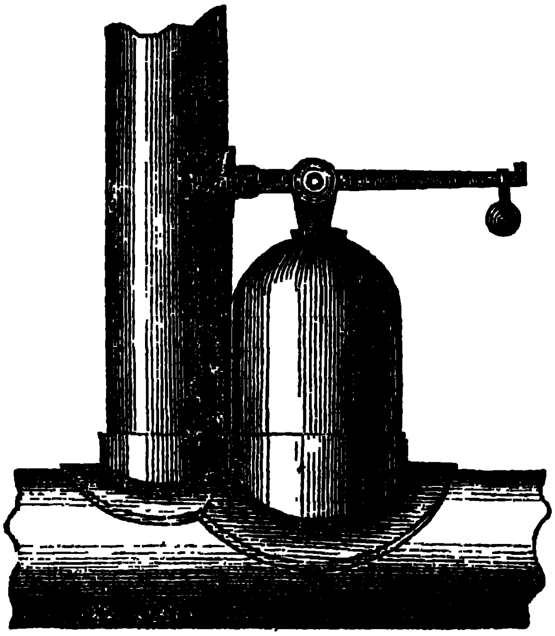


Fig. 2.

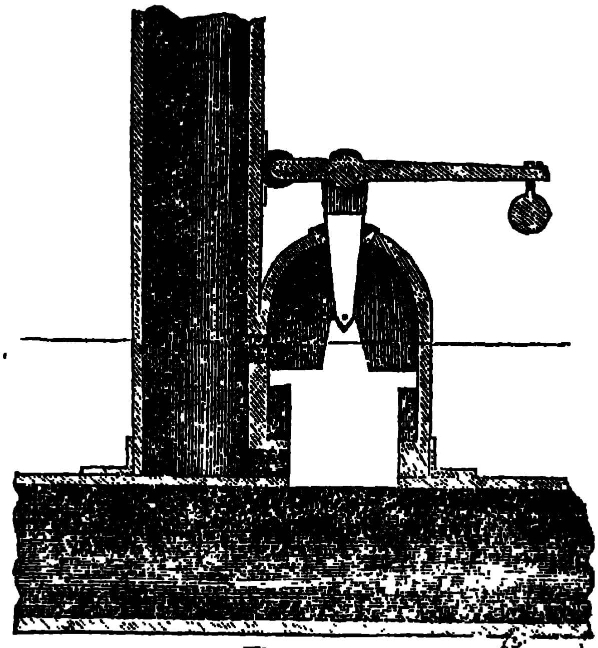


Fig. 3.

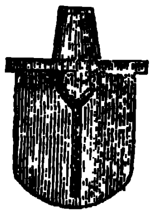
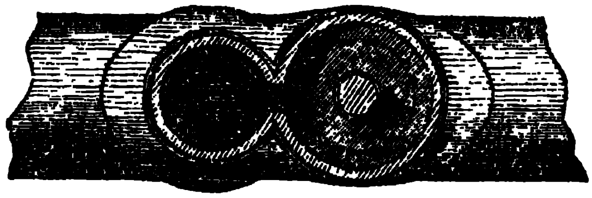


Fig. 4.



*New Safety Valve.*

Sir,—Encouraged by the promptitude and impartiality with which you inserted a letter I troubled you with on the subject of a "Steam Boat Alarm" for denoting the position and course of steamers in fogs, or at night, I am induced to submit to you a few remarks, accompanied with diagrams, on the "adaptation of valves of a new construction for insuring the safety of steam boilers," and in doing this, I feel confident, that should they be considered of any utility toward that highly important object, such will be best attained by being inserted in your widely-circulated Magazine, which, being consulted by all mechanics, will insure the subject practical and useful consideration.

On reading the various opinions on the safety-valve expressed in the Commissioners' Report on Steam Vessels, it appeared to me, that though it was considered necessary, that the engineer should have command of the valves; nevertheless, that much danger resulted from their liability to be tampered with, especially to enforce additional speed. The accompanying drawing exhibits a valve calculated to perform the ordinary operation of allowing the steam to escape when it shall have acquired a greater degree of power than the boiler is constructed to bear; while, at the same time, it is contrived to enforce the escape of the steam in the event of the valve being overloaded; thus, in fact, enforcing a security from an attempt to evade it; but, while I send this drawing to illustrate the subject, I rather wish to establish the principle than point out any mode of performing the same, knowing, on how many circumstances this must depend.

Trusting that it may be considered a subject of sufficient importance for your valuable Magazine, and that the accompanying drawing and specification may be sufficiently explicit, of which, if not, I shall gladly afford explanation on a letter to my address, which you have, for your own or any person's satisfaction that may wish for the same.

I remain, Sir, your very obedient,

A Young Engineer.

*Explanation of the Engravings.*

Fig. 1 represents an external view

of the new valve, not varying in appearance from the ordinary steel-yard valve in present use.

Fig. 2 is a section of the same, showing the improvement to consist in the valve itself, which has the shape shown in fig. 3, its lower part being smaller than the upper to allow of the introduction of four spiral springs, shown in fig. 4, by the four open circles; there are four small pipes, or channels, cut on the sides of the valve, one of which is seen in fig. 3, each branching into two others, as seen in figs. 3 and 4, by the eight black circles; these channels go down very near to the bottom of the valve.

There are two openings provided from the valve box to the waste pipe, the one above, the other near the bottom of the valve. The action of the valve is of the ordinary character, while the conditions are allowed their proper functions, but on any attempt at overloading, it will instantly descend, and thereby afford access for the steam to escape through the four channels in the valve, into the valve-box, and thence by the upper opening into the waste pipe, until the weight by which it has been everloaded is removed, when the action of the four springs restores the valve to its proper position and ordinary use.

## RUSSELL ON STEAM AND STEAM NAVIGATION.

*On the Nature, Properties, and Applications of Steam, and on Steam Navigation. From the Seventh Edition of the Encyclopædia Britannica. By John Scott Russell, M.A., F.R.S.E., Vice-President of the Society of Arts for Scotland, &c. &c. &c.* Edinburgh: Adam and Charles Black. 378 pp. 12mo., with 15 plates.

(Fourth and concluding Notice.)

In our first notice of Mr. Russell's work, speaking of it in a general sense, we gave it a hearty welcome, as a valuable and much-needed addition to scientific literature; and dwelt particularly on its value as containing the results of the scattered experiments of different nations on the elastic force of steam, reduced, where necessary, from foreign into English measures. In our second, we directed attention to Mr. Russell's narrative of the early history of steam navigation; and, while we commended the candour and discrimination of his statements, found ourselves, (not without surprise,) under the necessity of differing from him entirely in the conclusions drawn from them: for, whereas he assigns to Miller, Taylor, and Symington, in nearly equal proportions, the merit of originating modern steam navigation, we maintained that the facts, as cleared up and laid down by himself, showed indisputably that it belonged to Symington alone. In our third notice we adverted to the *questio vexata* of the difference, in point of duty, between the Cornish and other engines—animadverted on Mr. Russell's insufficient appreciation of the effects due to differences in the speed of pistons, and to his omission of the uses of the Indicator, as a means of solving the difficulty in question, and of the experimental evidence which it has already furnished. And in our present and concluding notice, we propose to address ourselves to the matter of Mr. Russell's fourth chapter, which treats of "the progress of steam navigation in America and Europe, from its introduction to its present condition."

Any person desirous of obtaining a correct account of the rise, progress, and present state of steam navigation in Great Britain, would doubtless go to our most esteemed Encyclopædia for its history, (if a foreigner, he most certainly would,) as being at once the most comprehensive and most authentic record. And if so, he could not but gather from Mr. Russell's version of the matter, that to Scotland, almost wholly, is Great Britain indebted for its present advancement; and that England has done little, if any thing, towards its extension or improvement. This portion of our author's pages would be more correctly designated, "The Superiority of Scotch Engineers asserted; or, a Wet Blanket for Old Father Thames. By a Modern Athenian."

Whether Mr. Russell's eulogiums savour of the shop, or the soil, they are most unfair to the English, and particularly London-made marine engines, which, if equalled by the Clyde engines, (which we deny,) are cer-

tainly not surpassed by them. In opposition to the inference from Mr. Russell's work, and in support of the fact, that England has done more for the extension of steam navigation than Scotland, we intended to have prepared authentic tables from parliamentary returns, to show the number of steamers built in Scotland and the number in England; but we are saved this labour by meeting with them in the pamphlet "On Steam Navigation," by Boyman Boyman, Esq., more than once recently referred to in our pages, from which we extract the following

# TABLE,

*Tracing the rise and progress of steam navigation in Great Britain and Ireland, and the Plantations, from* 1788 *to* 1838.

| Years. | ENGLAND. | | SCOTLAND. | | IRELAND. | | Total in United Kingdom. | | British Plantations. | | Total built in the British Empire. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Vessels. | Tonnage. | Vessels. | Tonnage. | Vessels. | Tonnage. | Vessels. | Tonnage. | Vessels. | Tonnage. | Vessels. | Tonnage. |
| 1788 | — | — | 1 | 4 | — | — | 1 | 4 | — | — | 1 | 4 |
| 1789 | — | — | 1 | 30 | — | — | 1 | 30 | — | — | 1 | 30 |
| 1795 | — | — | 1 | — | — | — | 1 | — | — | — | 1 | — |
| 1801 | — | — | 1 | 80 | — | — | 1 | 80 | — | — | 1 | 80 |
| 1812 | — | — | 2 | 65 | — | — | 2 | 65 | — | — | 2 | 65 |
| 1813 | 3 | 108 | 4 | 253 | — | — | 7 | 361 | — | — | 7 | 361 |
| 1814 | — | — | 5 | 285 | — | — | 5 | 285 | 1 | 387 | 6 | 672 |
| 1815 | 2 | 161 | 7 | 625 | — | — | 9 | 786 | 1 | 608 | 10 | 1394 |
| 1816 | 4 | 298 | 4 | 270 | — | — | 8 | 568 | 1 | 670 | 9 | 1238 |
| 1817 | 4 | 227 | 3 | 194 | — | — | 7 | 421 | 3 | 1633 | 9 | 2054 |
| 1818 | 3 | 1124 | 3 | 216 | — | — | 6 | 1340 | 3 | 1198 | 9 | 2538 |
| 1819 | 2 | 175 | 2 | 167 | — | — | 4 | 342 | — | — | 4 | 342 |
| 1820 | 3 | 102 | 4 | 403 | 1 | 150 | 8 | 655 | 1 | 116 | 9 | 771 |
| 1821 | 12 | 1463 | 10 | 1545 | — | — | 22 | 3008 | 1 | 258 | 23 | 3266 |
| 1822 | 23 | 2080 | 4 | 369 | — | — | 27 | 2449 | 1 | 185 | 28 | 2634 |
| 1823 | 17 | 2344 | 2 | 125 | — | — | 19 | 2469 | 1 | 52 | 20 | 2521 |
| 1824 | 12 | 1687 | 5 | 547 | — | — | 17 | 2234 | — | — | 17 | 2234 |
| 1825 | 19 | 2600 | 5 | 403 | — | — | 24 | 3003 | 5 | 1189 | 29 | 4192 |
| 1826 | 50 | 5920 | 22 | 2718 | — | — | 72 | 8638 | 4 | 404 | 76 | 9042 |
| 1827 | 18 | 2264 | 9 | 994 | 1 | 118 | 28 | 3376 | 2 | 408 | 30 | 3784 |
| 1828 | 25 | 1687 | 5 | 352 | — | — | 30 | 2039 | 1 | 246 | 31 | 2285 |
| 1829 | 13 | 1080 | 3 | 671 | — | — | 16 | 1751 | — | — | 16 | 1751 |
| 1830 | 10 | 931 | 8 | 814 | — | — | 18 | 1745 | 1 | 481 | 19 | 2226 |
| 1831 | 24 | 2054 | 7 | 695 | — | — | 31 | 2749 | 5 | 1687 | 36 | 4436 |
| 1832 | 19 | 943 | 14 | 1908 | — | — | 33 | 2851 | 5 | 1239 | 38 | 4090 |
| 1833 | 27 | 1964 | 6 | 964 | — | — | 33 | 2928 | 3 | 1017 | 36 | 3945 |
| 1834 | 26 | 3153 | 10 | 1675 | — | — | 36 | 5128 | 3 | 628 | 39 | 5756 |
| 1835 | 63 | 6814 | 23 | 4080 | — | — | 86 | 10924 | 2 | 357 | 88 | 11281 |
| 1836 | 43 | 5924 | 20 | 2834 | — | — | 63 | 8758 | 6 | 942 | 69 | 9700 |
| 1837 | 53 | 6223 | 22 | 4488 | 3 | 958 | 78 | 11669 | 4 | 478 | 82 | 12147 |
| 1838 | 66 | 6286 | 18 | 3263 | — | — | 84 | 9549 | 3 | 288 | 87 | 9837 |
| Total at each place. | 541 | 57942 | 231 | 31037 | 5 | 1226 | 777 | 90205 | 57 | 14471 | 834 | 104676 |

**No Steamers have been built at the islands of Jersey, Guernsey, and Man. The tonnage is exclusive of the space occupied by the engines.**

It will be seen from the preceding table, that, whilst Scotland has, down to 1838, built 231 steamers, of 31,037 tons, England alone has, down to the same period, built 541 steam-vessels, of 57,942 tons. But this table does not

include the steam navy of Great Britain, of which the following table, extracted from that excellent periodical, the *Colonial Magazine*, (No. 3,) gives, we believe, a correct account.

RISE AND PROGRESS OF STEAM-VESSELS IN THE BRITISH NAVY, 1828 TO 1840.

| | | Number. | Horses power. |
|---|---|---|---|
| In the year | 1828 | 4 | 400 |
| " | 1829 | 7 | 692 |
| " | 1830 | 8 | 792 |
| " | 1831 | 11 | 1,212 |
| " | 1832 | 14 | 1,652 |
| " | 1833 | 19 | 2,552 |
| " | 1834 | 20 | 2,792 |
| " | 1835 | 21 | 2,928 |
| " | 1836 | 23 | 3,168 |
| " | 1937 | 24 | 3,308 |
| " | 1838 | 55 | 6,622 |
| " | 1839 | 61 | 7,691 |
| " | 1840 | 76 | 10,661 |

The total tonnage of the 76 steam-vessels, forming part of the navy, amounts to 35,000 tons, and 10,661 horses-power; and all these, with the exception of four, were made by English manufacturers. This branch of the navy dates its existence from no earlier period than 1828. The actual horses-power of each government steam vessel is not given.*

The reader will observe, under the columns of England and Scotland, in our first table, that in 1816 this country equalled Scotland in the number of steamers built, and exceeded them in tonnage; and that from 1816, with two or three exceptions, she has in every succeeding year surpassed her in both.

Mr. Russell awards great praise to Mr. David Napier, of Glasgow, and not unjustly, for being the first (about 1818) to attempt the navigation of the open sea by steam; but he exaggerates that gentleman's merits considerably in saying, "that Great Britain owes to him the establishment of deep sea communication by steam-vessels, and of post-office packets." Mr. David Napier's "deep sea" achievements never extended beyond the adjacent coasts of Ireland, France, and Holland; and long before there was a single Clyde-built vessel which had run a voyage of more than twenty-four hours' duration, the skill and enterprise of the engineers of the Thames and Mersey had surmounted all the perils of the Bay of Biscay, and established a regular steam communication between England and Spain, Portugal, and the Mediterranean. Besides, Mr. David Napier, though an adventurous engineer—too much so, perhaps, for his reputation, which is unhappily identified with a greater loss of life from steam-vessel accidents than has fallen to the lot of any dozen other engineers that can be named—has never contributed any thing, (that we are aware of,) to *the means* by which deep sea navigation has attained to its present state of excellence. The beautiful adaptation of the beam engine to marine purposes—that arrangement which, introduced in 1819, has never since been materially departed from by beam-engine makers, whether of this or the other side of the Tweed—we owe to Boulton and Watt. The admirable workmanship for which English marine engines have become so famous all over the world, is to be solely traced to the rivalry which sprung up, about 1822, between Boulton and Watt, and Maudslays and Field, and has brought the Seawards, the Millers, and other able English competitors into the field; while, during the same period, Clyde workmanship had become almost proverbial for its *unworkmanlike* and inefficient character.

Again, who, may we ask, made the engines of those magnificent vessels which have so nobly upheld the supremacy of the British flag over the deep—which navigate all waters in all weathers, and seem to dare the nations and the elements to try conclusions with them? And, why is it that Mr. Russell has passed them over unnoticed? Not, surely, because of the fact before mentioned, that with the exception of four built within the last two years, they have been all made by English engineers. In 1838, when Mr. Russell wrote those papers for the Encyclopædia Britannica, which have been detached from it, and republished in their present shape, the British Steam

* The number of steam-ships of war has gone on increasing so rapidly, that at the date of our present publication it amounts to 102! And that exclusive of many vessels engaged in the mail service, which may at any time be converted into war steamers of the first class! With such a force, and such resources, England may at any time, (as of yore,) sweep the seas. All the rest of the world is at least ten years behind us in all that regards steam power, and its application to marine purposes.

Navy numbered no less than 55 vessels; and, in 1840, when that republication took place, affording to the author a convenient opportunity for making any required corrections or additions, the number had increased to 76. But, in 1840, as in 1838, Mr. Russell omits them entirely, from what he nevertheless gravely styles a history of "the present condition of Steam Navigation!"

Nor is the omission reprehensible merely, because of the number and magnitude of these war steamers; for there are improvements in construction connected with them, which ought not, on any account, to have been left out of a work professing to represent the state of steam navigation *as it is*. By the new class of engines, called the Gorgon engines, from their having been first introduced into the Gorgon frigate by the Messrs. Seawards, a saving of full one-fourth in weight, and one-third in engine room has been effected, as compared with beam engines of the older form; which, in a vessel of the size and power of the Gorgon, is equal to a saving of 225 tons of tonnage space, or the same thing, as enabling her to carry fifteen days' fuel, instead of ten, and thereby increasing her "deep sea" efficiency full one-half. The gain over beam-engines of *Clyde* construction is even greater than here stated; for it is a well ascertained fact—explain it as the Clyde engineers may, or Mr. Russell for them,—that the four war steamers they have fitted, (we allude to the Hecla, Hecate, Stromboli, and Vesuvius,) consume more than double the same quantity of fuel in the same time, which is consumed by any of the vessels supplied with London-made engines. Thus, a vessel with Scotch beam-engines of 300 horses power, will carry only 200 tons of coal, and these will last only seven days; while a vessel, with Gorgon engines of the same power will carry 300 tons, which will suffice for fifteen days' consumption. According to a return made very recently to the Admiralty (not yet published, but with a statement of the general results of which we have been obligingly favoured,) the average consumption of all the London-made engines supplied to the Royal Navy, (Boulton and Watt's included,) for a period of six months, was only 8½lbs. per horse power per hour, and some of them, (the Gorgon for instance,) consumed only 6½lbs.; while the lowest consumption of the four Scotch-fitted vessels has been 11lbs.; some of them have expended as much as 17lbs., and the mean is about 14½lbs. The inferiority of the Scotch engines, in this respect, is the more remarkable, that they have all been built within the last two years, and the makers of them have had it in their power to avail themselves of every improvement elicited by the preceding twenty years' experience of their English rivals; while the English-made engines, the average consumption of which we have stated to be only 8½lbs., includes many which have been from ten to fifteen years in nearly constant use. The first cost of Scotch engines is to be sure 25 per cent. less than that of the English; but it is a dear horse at any price which eats twice as much as others, and does less work.

It may not be out of place to notice here a difference which exists in practice, of which we suspect the public at large are but little aware, between the nominal power of marine steam-engines, (to which only our preceding statements have reference,) and the real power. The nominal power is that at which they are rated in casting up the first cost per horse-power; but it is the custom of engine-makers to give, as the saying is, a good deal into the bargain. In the case of London-made engines, the addition usually made to the nominal or selling power is as much as 75 per cent.; how much the Clyde makers are in the habit of allowing we do not know. If, therefore, we divide the consumption of the London-made engines, not by their nominal but by their real horses' power, we shall find that the average consumption, instead of 8½ lbs. per horse-power per hour, is only about 5 lbs. Whether the custom of which we speak has arisen from an anxious desire in engine-makers to err on the safe side, or has been generated by the eagerness of competition, we know not; but in any case we think it a pity that such a custom should exist. It is calculated to produce, and we have no doubt has produced, a great deal of misconception and error; and is quite unworthy of a profession, of which exactitude is, or ought to be, one of the most distinguishing characteristics.

Although the Gorgon plan of construction has passed uncommended, because evidently not duly appreciated by Mr. Russell, we must not leave it to be

inferred, from what we have said, that there is no mention whatever made of it in his pages. He has given an engraving of an engine on this plan, (copied, if we mistake not, from our own journal;) and mentions that it has been put into four frigates. But that is all; and even that little all is incorrect. Instead of *four* frigates, he should have said *eleven*, (exclusive of two or three vessels fitted for the Russian government, and for the East India Company;) and he might with propriety have added, that so well has it answered in all these instances, that not only Boulton and Watt, but his own keen-sighted countryman, Robert Napier, have commenced building engines on the same plan.

Another grievous sin of omission with which we think Mr. Russell fairly chargeable is, the silence he has observed with respect to that master-piece of marine enginery, and *chef-d'œuvre* of Maudslays and Field, the *Great Western*. The play of Hamlet, with the part of Hamlet omitted, (according to the old story,) is nothing to this. Great as have been the "deep sea" performances of the government steamers, (the best of them,) those of the *Great Western* have been greater still. She was the first vessel that successfully navigated the Atlantic, and, though she has had several powerful competitors, is the only one, (with the exception of the Halifax steamers, recently started by Messrs. Cunard and Co., and with which no comparison can as yet be fairly instituted,) which has continued to ply regularly between Great Britain and America—performing her voyages to and fro with almost as much regularity as any river pleasure-boat, and being now, after her forty-second voyage, and after having steamed about 130,000 miles—equal to going five times round the world—as tight and sound, and in as good working condition, as ever. Excellent, too, as the *Gorgon* plan of construction is, it must be confessed that it has effected little, if any thing, in point of economy of fuel, (however much in respect of weight and stowage-room,) beyond what has been accomplished in the case of the *Great Western*, by excellence of machinery, by careful clothing of the boilers, pipes, and cylinders, and by working the steam expansively. The nominal power of the *Great Western* engines is 400 horses, but the actual power, as shown by the Indicator, is 600, (diameter of cylinder 73 inches, stroke 7 feet;) the steam is worked from full pressure of 4 lbs. to two-thirds; the consumption of fuel is 7 lbs. per horse power per hour on the nominal power of the engines, or 4·66 on the actual power. The consumption of the *Gorgon* is rather less than this; but the average consumption of *all* the vessels fitted with engines on the same plan is 5 lbs.

Neither is Mr. Russell less deficient respecting the state of steam navigation in other countries. His chapter "On the Progress of Steam Navigation in Europe" in no degree comes up to its title. Of the state of this power in the foreign empires of Europe not a word is said, from which the reader could judge whether it were known at all out of Great Britain, or, if known, practised. We will therefore make our notice more complete by supplying the deficiency with the table given on our next page, compiled from papers presented to the House of Commons, on the motion of Sir R. H. Inglis, in 1837. The returns for foreign powers are not later than 1836.

A few more observations in conclusion. Mr. Russell, at p. 175, says, "We frankly admit that the river steamers of America stand in every respect, in science, in beauty, in magnitude, in speed, unparalleled by the river steamers of our own, or any other country." Is this really the fact? We have never seen the American steamers to form any opinion of their "beauty," but we cannot imagine that a correct eye would see symmetry of proportions, where there is no compactness. We suspect that an unsightly beam, like our mining engines, playing half way up the funnel, must be any thing but "beautiful." Beauty of this kind we hope never to see introduced in this country, to mar the exquisite proportions of some of our best river boats, such as the *Ruby*, the *Red Rover*, the *Star*, the *Blackwall*, the *Railway*, *&c.* In "magnitude," no doubt, the river boats of America surpass our own river steamers. The vast volume and rapidity of the American rivers, and the mighty scale on which nature has displayed her magnificence in the unequalled breadth and extent of her sublime rivers, render size indispensable. In "speed," we question greatly whether

*Comparative Statement of the Number, Tonnage, and Power of Steam Vessels, in 1836, in all Parts of the Globe where British Consuls, Ministers, or Agents, are accredited.*

| PLACES. | No. of Vessels. | Tonnage. | Horse-power. | No. of Engines built in England and Scotland | No. of Sea-going Steamers included in the preceeding | POWER OF SEA-GOING STEAMERS. From 100 to 150 horse-power. | From 150 to 200 horse-power. | From 200 to 300 horse-power. | From 300 to 400 horse-power. | From 400 to 500 horse-power. |
|---|---|---|---|---|---|---|---|---|---|---|
| France | 67 | 6,621 | 2,991 | 46 | 13 | 4 | — | — | | |
| Holland | 30 | 5,497 | 2,614 | 4 | 6 | 3 | 2 | — | | |
| Russia | 23 | unknown | 2,075 | unknown | 8 | 5 | 1 | 1 | | |
| Barbary States | 10 | ,, | 1,550 | 2 | 10 | 2 | 8 | — | | |
| Sweden | 27 | 1,200 | 1,244 | 1 | 5 | — | — | — | | |
| Sicily | 8 | 2,061 | 805 | 8 | 8 | 2 | 2 | — | | |
| Turkey | 2 | 1,088 | 320 | 2 | 2 | 1 | — | — | 1 | |
| Austria | 6 | 665 | 442 | 5 | 5 | 2 | — | — | | |
| Portugal | 4 | 790 | 380 | unknown | 3 | 1 | 1 | — | | |
| Tuscany | 3 | 869 | 335 | 3 | 3 | 2 | — | — | | |
| Sardinia | 5 | 979 | 315 | 5 | 5 | 1 | — | — | | |
| Denmark | 5 | 625 | 311 | 4 | 5 | — | — | — | | |
| Belgium | 3 | unknown | 224 | 3 | 1 | — | — | 1 | | |
| Prussia | 3 | 502 | 200 | 2 | 3 | — | — | — | | |
| Hamburgh | 3 | 273 | 192 | 3 | 2 | — | — | — | | |
| Spain | 4 | 626 | 150 | 4 | 2 | — | — | — | | |
| Mexico | 2 | 285 | 100 | — | — | — | — | — | | |
| Hanse Towns | 2 | 49 | 68 | 2 | 2 | — | — | — | | |
| Brazil | 3 | 270 | 48 | 3 | 1 | — | — | — | | |
| Mecklenburg | 1 | 82 | 40 | 1 | — | — | — | — | | |
| Total in 1836 | 211 | 22,482 | 14,604 | 98 | 84 | 23 | 14 | 2 | 1 | — |
| United States in 1838 | 800 | 160,000 | 57,019 | — | 14 | 5 | 2 | — | — | — |
| Total combined Steam Marine of the Globe, exclusive of the British Empire | 1,011 | 182,482 | 71,623 | 98 | 98 | 28 | 16 | 2 | 1 | — |

brother Jonathan does "go a-head" of us. The navigation of the two thousand miles of the rapid Missisippi is never accomplished in less than twenty days of constant steaming. And in "science," where is their superiority? They use steam expansively, and wisely so, and we are astonished beyond measure, that our engineers do not carry this principle to a greater extent in our own steamers. But in what other point of science do the Americans surpass us? They have scientifically blown up, by only two explosions, 230 human beings, 130 by the *Oronoko*, in 1838, and 100 by the *Moselle*. The greatest number blown up in England by one explosion was 24 by the *Union* in 1837, and whilst our accidents from all causes do not exceed 634 individuals destroyed in the United Kingdom down to 1838, America has blown up, and killed in various ways, from 1807 to 1838, 2,000. [See Report to Congress on Steam Vessels, dated December 12, 1838.] We should like, too, to know what quantity of fuel is consumed per actual horse power per hour by the American engines—the only true criterion of superiority of science. The rapid speed of pistons of 500 feet a minute, is not yet shown to be any improvement. Mr. Russell observes in p. 241, that the principle of using steam expansively in America, "is one great cause of the superiority in *speed* of American vessels." We do not see the soundness of this dictum. It will save coals, and lighten the draught of water, but how it should increase the speed of a vessel, is to us a mystery.

It is from no want of further matter for remark that we now conclude our notice of this work. Had our author less talent, we had taken less trouble to point out what appear to us serious errors in the execution of this work. He is an original thinker, and if his views have not always led him to sound conclusions, it is only what has happened to many greater minds before him. Works sent to the world, as "Encyclopædia Britannica Treatises," are looked at with greater severity of judgment than more fleeting publications.

The observations of Mr. Russell (p. 301—306) "on water-lines," deserve attention for their importance, and originality. We have not sufficiently considered the principles of hydrodynamics to give a correct opinion of the soundness of his views, but our author adduces practical results of his own science, very creditable to his independent consideration of the question, and analogical reasoning. The notices taken by Mr. R. of the various applications of steam to horticultural, domestic, and manufacturing purposes, and the addition of the able treatise on railways by Lieutenant Lecount, also greatly enhance the value of the work.

### THE APPARATUS FOR EQUALISING THE POWER OF STEAM-ENGINES.—MR. BUCKLE IN EXPLANATION.

Sir,—I feel called upon to notice a statement published in the *Mechanics' Magazine* of the 28th ult., in reference to an improvement in equalising the motion of Steam-engines, as I am therein represented to have put forth an "unwarrantable claim to the invention."

In the first place I had no knowledge of any person's intention either to write or publish a line on this subject; nor was I aware of Mr. Scott Russell's paper, until it was pointed out to me, in the *Encyclopædia Britannica.*

I am little disposed to make a parade of any success that may attend my exertions in the ordinary course of business, and much less so to make an "unwarrantable claim" to the merits or invention of another person; but however reluctant I may be to interfere with Mr. Lucy's monopoly of any credit which may belong to the scheme for which he has taken out a patent, I now feel it due to myself, as also to the public, that I should record the following facts:—

In the year 1831, as engineer for Messrs. Boulton, Watt, and Co., I superintended the making and erecting Mr. Lucy's forty-horse engine, and afterwards occasionally called to examine its condition, when he frequently complained of the irregular motion of his mill, and the rapid wear of the teeth of the wheels. In 1835 Mr. Lucy applied to me for a remedy, at the same time proposing two schemes, the one to be a *lever and weight*, and the other a *strong spiral spring*. To both of these proposals I made such objections as appeared reasonable to Mr. Lucy, who, after some consideration, entirely abandoned them. I then suggested the application of a *Pneumatic Pump*, the scheme now patented. Mr. Lucy being at that time totally unacquainted with the use of the pump, and also with any arrangement by which its power could be applied, it was only by repeated ex-

planations he at length became satisfied of its practicability. He then applied to Messrs. Boulton, Watt, and Co., to make the apparatus, and they agreed to do so on the understanding that they took no responsibility for its success. The drawings were then made by me, and I superintended the fitting and erection of the machinery and final completion of the scheme, and offered no impediment or objection to Mr. Lucy taking out a patent for it.

I have only to regret that the construction put upon Mr. Scott Russell's paper in the *Encyclopædia Britannica* should have led to the conclusion that I have set up any "unwarrantable claim" to the invention," and have compelled me in self-defence to give this explanation of its origin.

WILLIAM BUCKLE.

Handsworth, September 7, 1841.

### THAMES AND CLYDE-BUILT STEAMERS—L. P. IN REPLY TO A. M.

Sir,—Your correspondent A. M., in his last letter on "Thames and Clyde-built Steamers," asks how it comes, the Company who own the Turk, have bought these two vessels, the "Wallace" and "Burns?" I can only answer him as your esteemed correspondent Mr. Bayley has done, by saying that it might be libellous to state the true reason. If he is particularly desirous of knowing, I would refer him to the Director of the Company who made the purchase, and the engineer who went with him to the Clyde for the purpose. They can tell him if they like—the latter, by the by, is a Scotchman, who no doubt imagines, like Mr. John Scott Russell, that nothing is right in steam-engines or steam vessels but what is done in the Clyde. A. M. admits that I have given a pretty correct statement of the dimensions of the "Wallace," and goes on to say, that the 60 horse engines are only a nominal power, and further, that the "Wallace" being worked with steam of 7lbs., and making an average vacuum of 12½lbs., she will work to double her nominal power, or 240 horses. So much more to the discredit of her builders, as she did not beat the "Duchess of Kent," a vessel much larger than herself with only 140 horses power. A. M. wishes me to mention the pressure of steam the "Duchess" carries in her boilers; this I cannot do; but I will be prepared to furnish the particulars he requires, provided A. M. will in an early number give the diameter of the cylinders of the "Wallace," together with her draught of water when in best sailing trim; or, if he will furnish the area of immersed midship section it will do as well. A. M. says, that "I am told by a person, who has every opportunity of knowing, that she never went as well when she was trimmed in the way L. P. mentions." Why, I have not mentioned *any trim*: I only stated, that she had 15 tons of coals in her after-hold to bring her in trim, or to her proper lines; for surely A. M. does not mean to state that the builder of the "Wallace" intended her to go boring along with her head poked into the water like an old pig, which she most assuredly would have done, had she been without the said 15 tons of coals, which, if the engines had been placed in their proper position in the vessel, would not have been needed. However, as I said in my last letter, let A. M., or his countryman Mr. John Scott Russell, produce something to compete with the "Blackwall" or "Railway," before they talk of comparing the Clyde with Thames-built steamers. The latter vessel, I can inform them, is driving a 17 ft. wheel, 9 ft. 11 inches broad, and 15 inches deep, 33 to 34 revolutions per minute, with 7 cwt. of coal per hour; the pressure of steam in the boiler not exceeding 7lbs.

I am, Sir, your obedient servant,

Sept. 27, 1841. L. P.

### THE BLACKWALL STEAMER.

Sir,—You will greatly oblige me, by asking your correspondent (Mechanic) what matters the high pressure at which the engine of the Blackwall is worked, supposing the boiler and machinery strong enough to resist the pressure? And also, by asking him, whether he does not think the shock which he speaks of is caused by the rise and fall of the connecting machinery from the piston-rod to the crank—the engine in question being a steeple engine.

I am, Sir,
Your obedient servant,

25th Sept. DICQUE.

### AN IMPROVED MODE OF PAVING STREETS. BY EDWARD LOMAX, ASSOC. INST. C. E.

In this communication the author proposes to remedy the danger and difficulty of stopping or turning horses during wet or frosty weather, on wood pavement. His plan is, that a breadth of 2 feet 6 inches, near each side of the street, should be paved with stone, for the horses to travel upon, the carriage wheels still running upon wood; by which means, all the advantages of that kind of pavement would be preserved without risk to the horse. In very wide streets, a centre track might also be paved with stone.

By this plan, the labour of the horse would be greatly diminished, a considerable portion

of his power being now lost, because the wood pavement is less favourable for the footing of the horse, than for the motion of the wheels.

The author is therefore of opinion, that granite pavement for the horse to travel upon, and wood pavement for the wheel-way, would form a road on which the horse would work with least loss of power, and the greatest safety.

A model of the proposed improvement accompanied the paper.—*Trans. Inst. Civ. Eng.*

### AN IMPROVED PLANK FRAME, FOR SAWING DEAL PLANKS OF VARIOUS THICKNESS INTO ANY NUMBER OF BOARDS. BY BENJAMIN HICK, M. INST. C. E.

The principal improvement in this machine is a novel kind of gearing for producing what is usually termed the "taking-up," or "traversing" motion of the plank during the operation of sawing.

A revolving motion is given to two pair of coupled vertical fluted rollers, by means of worms and wheels, which are worked by a ratchet-wheel and catch, from the crank-shaft of the machine. When a plank is introduced between the moving rollers and the fixed guides in the centre of the machine, the tendency of the motion is to draw the plank forward at each stroke, with a force exactly corresponding to the degree of resistance opposed by the teeth of the saw. By this means, the necessity of any other support or side roller to the plank, during its progress through the machine, is avoided, and any number of planks of different length, depth, and thickness, can be put through the machine after each other, without any alteration, or stoppage of the work.

Several minor improvements are introduced in the general arrangement of the machine, particularly in the position of the crank-shaft, and connecting rod, which latter is placed in the centre of the moveable frame occupying a space which has not hitherto been made use of in machines for cutting two planks simultaneously; and by carrying the crank-shaft upon the framing, instead of having it fixed upon a separate foundation, the construction is simplified, as well as rendered less expensive.

The communication was accompanied by a working model of the machine.—*Trans. Inst. of Civ. Eng.*

### MAROONS AS SIGNALS ON RAILWAYS.—BY MR. EDWARD ALFRED COOPER.

The maroons are either small tin cases, or carcases of brown paper, charged with from ½oz. to two ounces of gunpowder, mingled with which are four of "Jones's Prometheans," which are small glass tubes, each containing a drop of sulphuric acid; the tubes are surrounded with chlorate (hyper-oxy-muriate) of potassa, and are each enveloped in a strip of paper.

In the event of an accident occurring, which renders it necessary to give notice that an approaching train should be stopped at a given point, two or more of these maroons are fastened upon the upper surface of the rail, by strips of lead attached to them. The wheels of the engine in passing over them, crush the glass tubes of the "Prometheans," the sulphuric acid inflames the chlorate of potassa, and causes an explosion of the gunpowder, which is distinctly heard by the engine driver, who immediately shuts off the steam, and puts down the break.

Mr. C. H. Gregory had permitted several trials to be made with these maroons on the Croydon Railway.

An engine was driven at full speed with a number of empty wagons attached to it, and with the steam blowing off to create as much noise as possible, yet the explosion of even half a drachm of gunpowder was distinctly perceived: he considered the invention to be practically useful.—*Trans. Inst. of Civ. Eng.*

### ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

*** *Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for that purpose.*

THOMAS SPENCER, OF LIVERPOOL, CARVER AND GILDER, *for an improvement or improvements in the manufacture of picture and other frames, and cornices; applicable also to other useful and decorative processes.* Petty Bag Office, September 8, 1841.

These improvements consist of particular applications of the new and important art to which Mr. Spencer originally gave birth, and are divided into ten heads.

The first comprehends a method of manufacturing picture frames in copper. For this purpose, a mould is made of the requisite pattern, from which a series of reverse or intaglio moulds are cast, in the usual manner. The cast, if not a conductor of electricity, is made one, and copper deposited upon it by the galvano-plastic process. When a sufficient thickness of copper is deposited, it is removed from the mould, and its back filled up flush with solder, and a metal rebate placed round

the inside, to receive the glass and picture. The frame is then ready for gilding.

Secondly, we have a similar method of producing moulds, by the galvano-plastic process, in which composition or papier machée ornaments may be cast; such moulds being also applicable to glass, earthenware, and china. An exact model of the ornament or other article being produced, it is attached to a perfectly flat surface, and both being made conductors, copper is precipitated thereon by the galvanic process. The copper mould thus obtained is tinned at the back, and filled up flush with metal, in order to give it the required strength.

Thirdly the patentee describes a mode of manufacturing obverse moulds in copper for casting therefrom ornaments, &c., in iron. Any desired pattern is rendered a conductor of electricity, and coated with copper by galvanism. In order to obtain a smooth surface at the back of the deposited copper, the cast on which the deposit is to be formed is placed horizontally in the vessel containing the cupreous solution, with its face downwards, and the copper surface which supplies the copper is placed upon the bottom of the vessel. The mould thus deposited may be used as an obverse mould for making patterns in sand for iron castings.

Fourthly, a mode of covering the surfaces of metallic picture or other frames with gold; the same process being likewise applicable to other surfaces, and to the raising or embossing of devices in gold or its alloys. For this purpose, a solution is prepared of pure gold, or of its alloys, in bromine or iodine, and to this mixture a few drops of sulphuric acid are added. The surface to be coated is cleaned in the usual manner, and then immersed in the solution, being connected with the positive wire of a galvanic battery; a surface of gold to be eroded is connected with the negative wire, and the battery put in action, when a deposition of gold is effected of any desired thickness.

Fifthly, a mode of employing silver for covering surfaces. The solution is prepâred as follows: silver is dissolved in bromine and alcohol, by means of galvanism, and this solution is allowed to precipitate a yellowish white powder; the liquid is then decanted, and the precipitate is boiled for ten minutes in thirty times its weight of a saturated solution of acetate of ammonia. Or a solution may be formed by dissolving an iodine of silver in prussiate of potassa, or any of the ammoniacal salts.

Sixthly, how metallic surfaces may be covered with platinum. For this purpose a quantity of platino-bichloride of ammonia is mixed with sixty times its weight of water, to which three parts of muriatic acid have previously been added; this mixture, after being boiled for about ten minutes, forms the solution, which is to be used in lieu of the usual solution of copper. Or bromine mixed with its bulk of alcohol is added to spongy platinum, and stirred or shaken till dissolved; this solution is then combined with half its bulk of dilute sulphuric acid, containing six times its weight of water, when it is ready for use.

If leaden surfaces are to be coated with platinum, they are cleaned by the usual method, and immersed for six hours in water containing half-an-ounce of either of the solutions of platinum to half-a-gallon of water, on its removal it will be found to have changed to a dark brown colour. If a more permanent coating is required, the lead is connected with a voltaic battery while in the solution, which should then be of double the strength. Lead so coated is applicable to surfaces used for the negative plates of galvanic batteries.

Seventhly, there is described a method of covering metallic surfaces with tin, applicable to the purposes mentioned under the fourth head. The metallic surface being thoroughly cleaned, is then placed with a surface of tin in a solution of acetate or muriate of ammonia, or sulphate of soda, and connected with a galvanic battery, by the action of which, tin is deposited of any required thickness.

Eighthly, a mode of cleaning surfaces of iron, and then covering them with copper, by means of voltaic electricity. The iron to be cleaned is attached by a wire to the platinum end of a voltaic battery, consisting of three pairs of plates, each plate having the same quantity of surface as the iron to be operated upon; another surface of iron is attached to the zinc end of the battery, and the two surfaces immersed in a saturated solution of sulphate of soda. In a few minutes the surface will be ready to be deposited upon, when it is attached to the zinc end of a battery of three pairs of plates, and a piece of copper is connected with the platinum end of the battery; the copper and iron being immersed in a solution of copper, copper is deposited on the iron surface.

Ninthly, a method of producing enriched surfaces, applicable to picture frames, cornices, and other decorative purposes, by the use of embossed calico, paper, or other similar fabrics. The pattern being embossed on the fabric by dies or rollers, is cut out and cemented on to the surfaces to be enriched, a coating of thick whiting being first applied to the hollow side to fill up the spaces, and give it the required strength.

Tenthly, a method of improving the texture of the composition used for casting

ornaments for picture-frames, cornices, and decorations, by adding to the materials usually employed for this purpose, caoutchouc dissolved in spirits of turpentine, asphalte, pyroligneous spirit, or spirit of tar, in the proportion of 1lb. of the caoutchouc to every 6lbs. of glue, used in making the composition.

The claim is, 1. To the application of voltaic electricity to the manufacture of picture, and other frames.

2. To the application of voltaic electricity to the manufacture of moulds for the purposes mentioned.

3. To the application of voltaic electricity for the purpose of making patterns or moulds for iron founders, in copper.

4. To the use of bromine and iodine combined with gold, in conjunction with voltaic electricity, for the purposes before mentioned.

5. To the use of bromine and iodine combined with silver, in conjunction with voltaic electricity, and applicable to the surfaces mentioned under the fourth head.

6. To the use of the solution of platinum, in conjunction with voltaic electricity.

7. To the use of bromine combined with platinum, and in conjunction with voltaic electricity.

8. To the covering lead with platinum, and applying it for the first time to the use above mentioned.

9. To the covering the surfaces mentioned under the fourth head with tin, by the particular methods described.

10. To the method of cleaning iron surfaces, and the regulation of the quantity and intensity of electric force necessary to render iron fit to be deposited on, for the first time pointed out.

11. To the method of producing embossed or enriched surfaces on picture and other frames, and cornices, being also applicable to other interior decorations.

12. To the application of caoutchouc for the purposes before mentioned.

JOHN VARLEY OF BAYSWATER TERRACE, ARTIST, *for an improvement in carriages.*—Petty Bag Office, September 8, 1841.

This improvement (if such it be) consists in the application of an additional pair of wheels to ordinary two-wheeled carriages, and in the application of an additional pair of hind-wheels to four-wheeled carriages, either alone, or in conjunction with an additional pair of front-wheels.

In applying the additional wheels to two-wheeled carriages, the ordinary axle is cranked at each end, and the additional wheels, which are about half the size of the ordinary ones, are applied on a separate axle inside the same, being placed so forward as to avoid an extreme cranking of the first axle. When it is desired to avoid cranking altogether, and to retain the axle of the outer wheels of the usual straight form, the axle of the additional wheels is placed half their diameter before or behind the axle of the ordinary wheels.

On the cranks of the ordinary axle, the outer springs of the carriage are applied in the usual way, and just within them are the springs belonging to the action of the inner wheels.

The additional hind wheels are applied to four-wheeled carriages in a similar manner.

The improvement in applying front-wheels consists in the use of two, three, or four wheels, which are connected to the carriage in a peculiar manner, which will be sufficiently explained by the following description of the manner of applying two of such wheels. The two wheels are placed equidistant from the centre of the front of the carriage, and parallel to each other, but one is a little in advance of the other. These wheels are mounted in frames, from the tops of which rise two rods, passing through guide-irons attached to the fore part of the carriage, and terminating at the top in swivel-pins, by which they are connected to a pair of elliptic springs, and which allow the wheels, frames, and rods to turn freely.

In order that the wheels may always turn together, the following arrangement is adopted: a circular horizontal plate is fastened on the top of each wheel-frame, having a groove of sufficient breadth to receive a belt, which connects them together, and which is prevented from slipping by being fastened to each plate. The pole-stock turns on a centre-pin in an arm which projects from the centre of the lower part of the front of the carriage. Two staples rise from the pole-stock, and pass through metal holes in the belt, so that when it turns, the staples carry the belt with them, thereby moving the circular plates, and causing a simultaneous movement in the two wheels.

To avoid straining the centre-pin, the end of the stock is turned up beneath the carriage, and fits in a circular groove in its bottom, and this groove bears the strain, and relieves the centre-pin, both in pulling, or in backing of the carriage.

The claim is, to the application to carriages, of wheels placed parallel and contiguous to each other, whereof one is in advance of, or overlapping the wheel contiguous to it.

WILLIAM NEWTON, OF CHANCERY-LANE, CIVIL ENGINEER, *for certain improvements in machinery or apparatus for picking and cleaning cotton and wool,* (a communication.)—Rolls Chapel Office, September 15, 1841.

These improvements are effected by causing a number of points upon a revolving cylinder

to strike in rapid succession against the fibres of the wool, cotton, &c., in order to separate all foreign matters, by an operation analogous to picking them out by hand.

The machine consists of a strong wooden frame, the upper part of which sustains the bearings of the cylinders, &c. An endless apron or feeder passes round two rollers, above the inner one of which, a top or pressing roller turns in slotted bearings; as the wool, &c., is fed in between these rollers, it is taken up by rows of points on a revolving picker cylinder, and delivered on to a fine comb cylinder. This cylinder is fluted in the direction of its axis to receive 8, 10, or 12 rows of fine combs. The teeth of these combs consist of steel points $\frac{1}{8}$th of an inch long, and about the same distance apart, which slope backwards in the direction of the rotation of the cylinder, and are inserted in strips of metal let into the periphery of the cylinder. In front of the fine comb cylinder is a fluted roller, by which the burs, seeds, &c., are beaten, picked, or separated from the wool or cotton; and this roller is so placed, that its projecting edges come nearly in contact with the fine comb cylinder. The roller and fine comb cylinder both revolve in one direction, by which means the edges of the plates come in contact with the seeds, burs, &c., in the fibres, when they are brought up by the combs, and strike them off, or pick them out without injury to the fibres, the space between the roller and the cylinder being just sufficient for the passage of the fibres. The teeth of the picker cylinder, which supply the wool or cotton to the fine comb cylinder, serve also to throw down the dirt, &c. which is detached by the fluted roller, and cause it to pass through a grating beneath the picker cylinder. As the fine comb cylinder revolves, its points come in contact with a doffer cylinder, which removes the cleaned fibres from its points, and prepares them to receive fresh supplies of wool or cotton from the picker cylinder, as before.

Various modifications of the above machine are shown, as also several different methods of constructing the fluted roller. In lieu of the flutes, the roller may have two or three rows of teeth on a part of its circumference, and have a vibratory, instead of a rotary motion given to it.

RICHARD LAMING, OF GOWER-STREET, BEDFORD SQUARE, SURGEON, *for improvements in the production of carbonate of ammonia.* Rolls Chapel Office, Sept. 15, 1841.

Instead of distilling an ammoniacal carbonate direct from any substance capable of producing it, the patentee obtains the salt, either in a solid state, or dissolved in water, by mixing together its acid and alkaline constituents.

One of the modes adopted consists in causing the gas of ammonia, and carbonic acid gas to traverse a succession of leaden chambers, so contrived as to favour the admixture of the gas, and kept as cool as possible. Sometimes a stratum of water, or of water impregnated with ammonia, is placed in one or more of the chambers, and the two gases introduced into it, in which case the resulting saline solution contains a larger proportion of carbonic acid gas than is obtained when the hygrometric moisture only of the aeriform fluids is present.

The claim is—1. To the making of carbonate of ammonia, by mixing its acid and alkaline constituents in any convenient apparatus, in all cases in which those constituents are obtained by different processes, and whether they are pure, or more or less mixed with air, or other gases or matters.

2. To the formation of the sesqui-carbonate, the carbonate, and bicarbonate of ammonia, or any mixture of them, by the exposure of carbonic acid gas to ammonia in solution, either alone or mixed with one or more of the carbonates of ammonia.

GEORGE LOWE, OF 39, FINSBURY-CIRCUS, ENGINEER TO THE CHARTERED GAS COMPANY, *for improved methods of supplying gas under certain circumstances, and of improving its purity and illuminating power.* Enrolment office, Sept. 16, 1841.

The first of these improvements, of which there are three, consists in communicating a moving power to gas meters, independent of, or in aid of that produced by the gas passing through them, so as to prevent any deficiency in the supply of gas.

For this purpose the axis of the meter is prolonged, and a small overshot water-wheel placed on the end of it; being enclosed within a case, the feet of which correspond with those of the meter. The lower part of the case is cut away, so as to form a race for the water which is carried off by a waste-pipe. Whenever it is desirable to increase the motion of the meter, in order to obtain a larger supply of gas, water is led through a funnel on to the wheel, which causes it to revolve, as required.

Other mechanical means, such as a falling weight, &c. may be employed for the same purpose, in lieu of the water-wheel, if preferred.

The second improvement consists in increasing the surface of that part of the meter which measures the gas, by adding a rim about one inch wide around its circumference, for the purpose of increasing its saturating power when charged with a hydro-carbonaceous fluid, as patented by Mr. Lowe in 1832. And also to enable it to act as a purifier when charged with a solution of caustic potash or soda, instead of water.

The third improvement consists of a mode

of purifying and saturating the gas in a separate vessel made of tin or other suitable material, and divided into two parts by a central partition; on each side of this partition there are three shelves, on each of which a stratum of sponge is placed. A solution of caustic potash or soda is introduced through a funnel at the top of the vessel, and saturates all the sponges on one side of the partition, while the sponges on the other side are in the same manner saturated with naphtha. On gas being admitted beneath the sponges filled with the caustic alkaline solution, it passes up through them, and proceeding through an opening in the upper part of the partition, descends through the sponges containing the naphtha, and escapes at the bottom of the vessel.

In passing through the alkaline solution, the sulphuretted hydrogen and carbonic acid are extracted from the gas, while its illuminating power is increased by its passage through the naphtha. If the object is to extract the ammonia from the gas, a diluted acid is substituted for the alkaline solution; or if the vessel is made with three sets of shelves, the three operations may be carried on simultaneously.

Similar effects may also be produced, by passing the gas over a series of shallow trays filled with the fluids abovementioned.

ROBERT WARINGTON, OF SOUTH LAMBETH, GENTLEMAN, *for improvements in the operation of tanning.* Enrolment Office, September 16, 1841.

The first of these improvements consists in using solutions of carbonate of potash or soda, (in the proportions of 1 or 2 lbs. of the carbonate to 10 gallons of water,) for soaking or preparing skins for unhairing.

The second, in preparing skins for unhairing, and at the same time swelling them, by means of various agents, of which there are three classes, viz., 1. Baryta, potass, and soda. 2. All acids, except the sulphuric. 3. Vegetable substances, such as rhubarb, sorrel, vine-dressings, &c. Of the first class, preference is given to a solution of soda, in the proportion of from half-a-pound to a pound in 10 gallons of water, rendered caustic by half its weight of quick-lime. Of the second class, diluted muriatic acid, in the proportion of from half-a-pound to two pounds of acid, (sp. gr. 1·17,) in ten gallons of water. And of the third class, rhubarb bruised and mixed with water, in the proportions of from one to ten pounds to each gallon of water.

The third, in the use of a solution of carbonate of ammonia, in the operation of graining hides and skins; the proportions varying from half-a-pound to four pounds of the carbonate to ten gallons of water.

The fourth, in mixing vegetable matters, (rhubarb, potatoes, &c.,) and chemical agents, (as gum, starch, &c.,) capable of retarding oxidation, with the tanning agent employed, in small proportions.

The fifth, in the use of a solution of bichromate of potash, (in the proportions of from one-eighth to half-a-pound to 100 gallons of water,) for the preservation of animal matters, so as to prevent putrefaction. Or diluted sulphuric acid may be used for this purpose; the skins, &c., in their moist state, being kept immersed in the solution, free from dust.

CHARLES BUNT DYER, OF PARY'S MINE, ANGLESEA, MINE AGENT, *for an improved method of obtaining paints or pigments by the combination of mineral solutions and other substances.* Enrolment Office, September 16, 1841.

This improvement consists in the addition to the waters which flow from copper, tin, or coal mines, and hold in solution any of the salts of iron, copper, &c., of a peculiar mixture of lime and water, or instead of lime any other calcareous substance.

By this means a yellowish-coloured precipitate is obtained, which may be either used as a pigment in its original state, or it may be converted by calcination into a paint of any of the colours capable of being obtained by that process.

JOHN AINSLIE, OF REDHEUGH, NORTH BRITAIN, FARMER, *for a new and improved mode of making or moulding tiles, bricks, retorts, and such work, from clay, and other plastic substances.*—Rolls Chapel Office, September 16, 1841.

A compressing and moulding frame contains two feeding rollers placed about half-an-inch asunder to admit the clay between them, and connected by toothed gearing; immediately below the space between the rollers there is a scraper for guiding the clay. After the clay has been led down the scrapers, it is acted on by a screw, so calculated, that for each revolution of the rollers the screw will make a third more. This screw revolves in a case accurately formed, with a slit in its top to admit the clay, which is caused to proceed through a peculiarly formed chamber combined with the moulds, and which, when constructed for making drain tiles, is formed in the roof with diverging arches, each leading to its corresponding mould, so that the clay in its progress to the mould receives an embryo shape, and discharges itself in straight lines. On being forced out of the moulds the clay is received upon an endless web of the conveying and cutting frame. This frame contains four cutting wheels, driven by gearing from the feeding rollers before mentioned, and beneath these wheels is an endless web, travelling over a series of rollers. The

tires of these wheels are about an inch broad, and have a flange on the side next the frame, about ⅜ths of an inch broad, and across the tire small grooves are cut, about ⅛th of an inch in breadth, and rather less in depth and about 2 inches apart all round, to obtain adhesion. Two chains are stretched over the tires of the wheels, the links of which are composed of plates of about $\frac{1}{16}$th of an inch in thickness, five and four plates being placed alternately in each link. These chains are led over the wheels, and down under a small fluted roller at each side of the frame, the use of which is to keep the wires by which the clay is cut, distended.

The action of this frame is as follows:—The clay being forced out of the moulds by the movement of the screw, it is received upon the endless web, and the wires descending as low as the web, and travelling in the same direction, cut the clay into the required lengths, which are received at the other end of the web, by the attendant, and by him regularly renewed.

JOSEPH MAUDSLAY, OF LAMBETH, ENGINEER, *for an improvement in the arrangement and combination of certain parts of steam-engines, to be used for steam navigation.*—Rolls Chapel Office, September 16, 1841.

This improvement consists of an arrangement of marine steam-engines, of which we published a description with engravings at p. 118 of No. 940. The steam cylinder has a small open topped cylinder placed concentrically within it; the piston is a broad ring or annulus, which fits the space between the interior of the large, and the exterior of the small cylinder. The piston is jointed to the lower end of the connecting-rod in the following manner; two vertical piston-rods rise from opposite sides of the piston, and passing up through stuffing-boxes in the cover, are united to a T-shaped cross-head; the upright stems of this cross-head descend into the small cylinder, and the lower ends are attached to a guide-block, to which the connecting-rod is also attached by a joint-pin, which pin, according to the length of the upright stems of the cross-head, may be placed either above or below the piston, or level with it. The cross-head is composed of two parallel plates, united at the extremities of the horizontal arms, a sufficient opening being left between them for the working of the connecting rod.

The claim is to the improvement in the arrangement and combination of the different parts of steam-engines to be used for steam-navigation. The distinguishing character of that improvement being, that the connecting-rod, with its appurtenances is situated, and works within, a small open topped cylinder, which is fixed in the central part of the steam-cylinder, and within the central part of the annular piston.

WILLIAM NEWTON, OF CHANCERY-LANE, CIVIL ENGINEER, *for improvements in spinning and twisting cotton, and other materials capable of being spun or twisted* (a communication.)—Rolls Chapel Office, September 16, 1841.

These improvements relate chiefly to that kind of spinning machine known as the "cap-spinner," or "Danforth's throstle," and consists in a mode of supportiong the bobbins by the same band that drives them. The other improvements relate merely to the arrangements of the pulleys employed in driving various parts of the machinery, and in a mode of supplying oil to the spindles.

For the first purpose, two endless bands are used for supporting and driving the bobbins at front and at the back of the machine. The endless band commences at one end, and passes along to the other end of the machine, parallel with the lifter or copping-rail, about half-an-inch above it, and at a proper distance in front of its row of spindles. On reaching the farther end of the machine the band passes round a series of pulleys, and then returns behind the spindles, and passes round a similar series of pulleys at the opposite end of the machine. The bobbins rest on these bands, that part of the band which is in front of the spindles travelling in one direction, and that part which is behind them travelling in the opposite direction, whereby a rapid rotary motion is communicated to the bobbins, while they are at the same time supported upon the driving bands.

WILLIAM THOMPSON CLOUGH, OF ST. HELENS, LANCASHIRE, ALKALI MANUFACTURER, *for improvements in the manufacture of carbonates of soda and potash.* Enrolment Office, Sept. 17, 1841.

These improvements consist, firstly, in neutralizing the causticity of the salts of soda and potash, by means of silica, and thereby to facilitate the obtaining of crystals of carbonate of soda.

Secondly, obtaining carbonate in combination with silicate of potash or soda, by which means the properties of the carbonate will be materially enhanced, and rendered more useful for bleaching and other purposes. In this mode of preparing carbonate of soda, a quantity of silica is thrown into the furnace with the alkali in such proportions as to saturate the caustic alkali, and thus convert it into silicate of potash or soda. Silica is also added to the alkaline liquor in the boiling-down furnace. Or it is preferred, to mix from 10 to 15 per cent. of silica with the salts from the boiling-down furnace, and then throw the combined materials into the finishnishing or carbonating furnace.

In manufacturing potash, the same methods are pursued, only that 7 per cent. of silica is added to it, instead of 10 per cent.

Upon crystallizing the carbonate of soda, the mother salts of the residual liquor retain all the silicate of soda, whilst the greater part of the carbonate separates from it in nearly pure and colourless crystals.

LAWRENCE KORTWRIGHT, OF EAST HAM, ESSEX, ESQUIRE, *for certain improvements in treating and prepaaing the substance commonly called whalebone, and the fins and such like other parts of whales, and rendering the same fit for various commercial and useful purposes.* (A communication.) Petty Bag Office, September 17, 1841.

The strips or lengths of whalebone are bound between two laths of wood, and placed in a steam-tight tube, and subjected to the action of steam for a time; when the whalebone is sufficiently softened, it is taken to a compressing machine, consisting of a bed or table furnished with side-pressers or clamp pieces, and over the space between them, with a vertical presser bar. This bar is acted upon by powerful levers, the shorter ends of which form eccentric wedges. The strip of whalebone between the laths is placed edgeways upon the bed, between the side-pressers, and the levers being brought into action by ropes and windlasses, force down the presser bar and compress the whalebone, the laths being softened by the steam allowing it to expand sideways.

Strips of whalebone being thus compressed in width, are proportionally increased in thickness, and adapted for making walking-sticks, whip-handles, ram-rods, &c.

The claim is, 1. To the mode of operating upon strips of the article called whalebone, for the purposes above named. 2. To the machinery, press, or apparatus, for effecting the operation of compression.



## LIST OF SCOTCH PATENTS GRANTED BETWEEN THE 22ND OF AUGUST AND THE 22ND SEPTEMBER, 1841.

William Lewis Rham of Winkfield, Berks, clerk, for certain improvements in machinery or apparatus for preparing land, and sowing or depositing grain, seeds and manure. August 23.

Nathan Waddington of Hulme, Lancaster, engineer, for certain improvements in the construction of boilers and boiler-furnaces. August 25.

John Cox of Gorgie Mills, Edinburgh, tanner and glue manufacturer, for improvements in apparatus for assisting or enabling persons to swim or float and progress in water. August 25.

James Sidebottom of Waterside, Glossop, Derby, manufacturer, for certain improvements in machinery, or apparatus for preparing cotton and other fibrous substances for spinning. August 30.

Francis William Gerish of East Road, City Road, Middlesex, patent hinge-maker, for improvements in locks and keys and other fastenings for doors, drawers, and other such purposes. September 2.

Samuel Hardham of Farnworth, near Bolton, Lancaster, spindle and fly maker, for certain improvements in machinery or apparatus for roving and slubbing cotton and other fibrous substances. September 3.

Louis Lachenal of Tichfield-street, Soho, mechanic, and Antoine Vieyers, of 40, Pall Mall, watch-maker, both in the county of Middlesex, for improvements in machinery for cutting cork. September 7.

Joshua Taylor Beale, of East Greenwich, Kent, engineer, and Benjamin Beale of the same place, engineer, for certain improvements in steam-engines. September 8.

Charles Sneath of Nottingham, lace-manufacturer, for certain improvements in machinery for the making or manufacturing of stockings or other kinds of loop-work. September 13.

Lawrence Kortwright of Oak Hall, East Ham, Essex, Esquire, for certain improvements in treating and preparing the substance commonly called whalebone, and the fins and such like other parts of whales, and rendering the same fit for various commercial and useful purposes. (Being a communication from abroad.) September 14.

William Newton, 66, Chancery Lane, Middlesex, civil engineer, for certain improvements in machinery for making pins and pin-nails. (Being a communication from abroad.) Sept. 15.

Thomas Craddock of Broadheath, Radnor, farmer, for certain improvements in steam-engines and boilers. September 16.

William Newton, 66, Chancery Lane, Middlesex, civil engineer, for certain improvements in looms for weaving. (Being a communication from abroad.) September 17.

William Scamp, of No. 11, Upper Charlton Terrace, near Woolwich, Kent, surveyor, an application of machinery to steam vessels for the removal of sand, mud, soil, and other matters from the sea, rivers, docks, harbours and other bodies of water. September 21.

Thomas William Berger, of Upper Homerton, Hackney, Middlesex, gentleman, for improvements in the manufacture of starch. September 22.

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# THE PATENT FURNACES OF CHARLES W. WILLIAMS, ESQ.

Fig. 1.

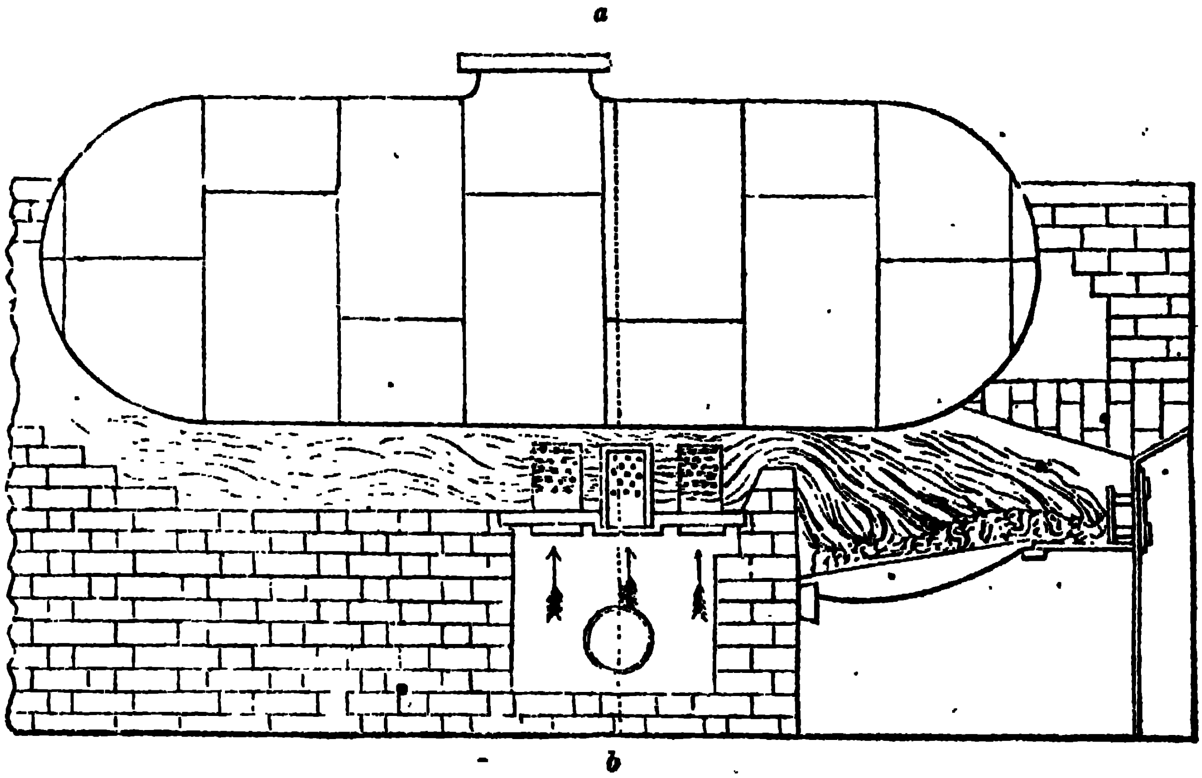
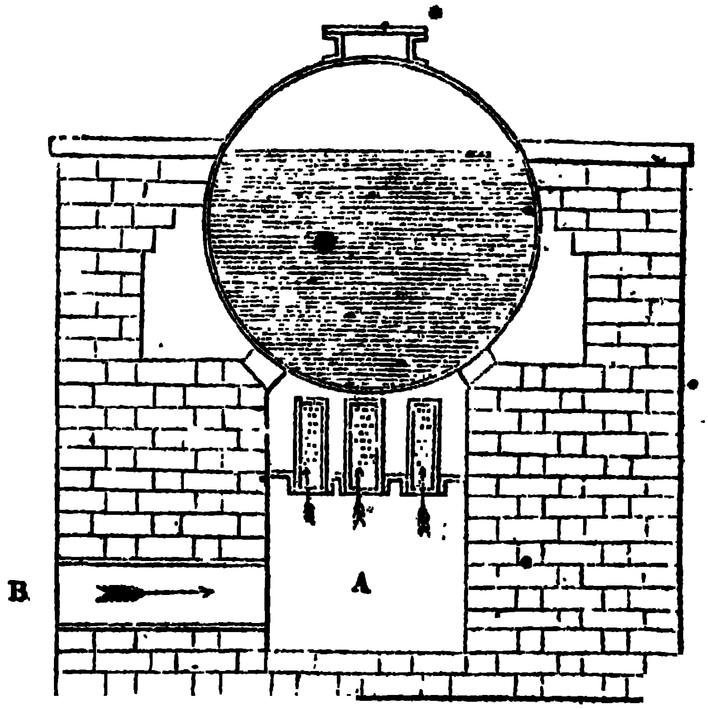



Fig. 2.



## THE PATENT FURNACES OF CHARLES W. WILLIAMS, ESQ., LIVERPOOL, FOR ECONOMISING FUEL AND PREVENTING SMOKE.

It has with great justice been remarked by Professor Brande, "that, when *scientific* men urge new views, or suggest the practical adoption of rational theories, they are neglected, because it is presumed they are merely founded on unsubstantial hypotheses; and on the other hand, when *practical* men attempt to found improvement on scientific principles, they are sneered at as dabblers in science." Instances of the truth of these observations are unfortunately two numerous to require any very particular enumeration. Improvements of acknowledged merit are very tardily admitted into general use. Watt's improved steam-engines were not properly introduced until after he and his partner had stocked their premises with unsold work to the amount of 50,000*l.* The illuminating power of coal gas was long known before it superseded the dim uncertain light of common oil lamps and torches. And it is but another exemplification of the same spirit, that in an age which boasts of the rapid strides made in scientific knowledge by such men as Dalton and Faraday, we are conducting combustion in our steam-engine boiler and other furnaces, on a system not only most wasteful and deleterious to the surrounding atmosphere, but as unscientific and rude as can well be imagined. We contrive to burn our lesser fires—our Argand and "solar" lamps—*without* smoke; but our greater fires, our boiler and other furnaces, we allow to produce it in noxious abundance, and seem even to view its escape with some degree of self-complacency, as an irrefragable proof of the industrious manufacturing operations carried on below.

The *chemistry of combustion* has by no one been carried out in a more practical and beneficial manner than by our esteemed correspondent, Mr. Charles Wye Williams, the author of "The Combustion of Coal and the Prevention of Smoke, chemically and practically considered."* Mr. W. is the inventor of a furnace, so constructed as to revive, or keep up the combustion of the inflammable gases, which are now allowed in common furnaces to escape in large volumes at every fresh charge of coal. This invention he has had in practical use upwards of two years, and we understand with invariable success. It has been adopted both for land and marine engines, and is capable of being applied to all descriptions of furnaces.

The engraving, fig. 1, shows a cylindrical boiler, the furnace of which, it will be observed, presents no external difference from a boiler of the common kind; all the new apparatus lies behind the bridge, where there is, what is termed, an air-chamber. The arrows represent the direction of the air through upright pipes, closed at top and drilled all round full of holes.

Fig. 2 gives a sectional view, taken vertically through the air-chamber A; and here the arrangement of the perforated tubes will again be seen, closed at top, but open entirely at their lower ends for a free admission of the air. They fit air-tight into an iron plate, covered over with fire-clay, and forming the roof of the chamber. The air is admitted to the chamber through the side wall at B.

In fig. 1, the perforated tubes appear *in* the flame, though it answers fully as well, we are informed, to place them lower down. The plan, represented in fig. 1, has been found in practice very effectual in favouring the combustion of the gases, but it is only one of several arrangements, all on the same principle, to suit differently constructed boilers and furnaces, which arrangements it is not at present requisite here to discuss.

Most of the furnaces set up on Mr. Williams's plan have had one or more perforations made in the brick-work, with a spy-hole inserted to enable the attendants to observe the action of the flame behind the bridge and within the flues. It is almost impossible adequately to describe the difference in effect between the new and the old system. When the air-chamber is closed, and thereby rendered inoperative, all is dark, or at most, a dingy dull-red light appears, rendering nothing distinguishable. The moment air is re-admitted, it is like the rapid

* Second Edition, illustrated with coloured Diagrams, 8vo. Simpkin, London, 1841, pp. 184.

clearing up of a dense fog, and a return from night to the brightness of day. The large body of gas which enters at once into perfect combustion, produces a surprisingly beautiful smokeless flame and bright light. All the brickwork is distinctly seen, as clean as if fresh built. Every aperture in the pipes affords, in appearance, a gas flame. It is in reference to this latter effect, that Dr. Brett says, in a printed letter addressed to Mr. Williams, "by causing atmospheric air to be driven, *by jets*, among the inflammable gases, you employ, as it appears to me, the only means practicable, in operations on a large scale, of causing a sufficient mechanical admixture between the air and the gases to be burnt." A ton of good coal is estimated to afford 10,000 cubic feet of gas; now it would be worth the while of every calculating manufacturer, to take the trouble to enquire what portion of the gas thus produced in his furnace is absolutely so consumed, as for its heat to become available; and what portion is carried off by the draught in its impure unburnt state (but capable of being advantageously consumed,) and condemned as being mere smoke. The crude gas issuing from a fresh supply of coal does appear thick and dark *like* smoke, but it has no sooty property, as may be proved by holding white paper above it on a common fire, or issuing from a small iron retort. If now inflamed, and thus imperfectly burned, it will afford abundant evidence of sooty smoke. It is this imperfect combustion, then, which takes place in every common furnace, and which Mr. Williams's improvements are calculated at once to remedy. It is not the *burning of smoke* that we ought to expect, but the *prevention* of the burning, and it is not saying too much to declare the former an absolute chemical absurdity.

In towns and populous districts, the removal of the much-complained of smoke nuisance will ever be hailed as no small triumph of scientific skill and ingenuity; but apart from even this consideration, to neighbourhoods where bleaching is extensively carried on, it will prove highly important, and in many manufactures, where an intense and smokeless flame is required, this invention offers manifest advantages. Not the least of its merits is the fact of its allowing the perfect combustion of all the fuel on the bars, and of all the gaseous products of that fuel—so that where *all* is consumed, some great saving to consumers of coal must certainly be effected.

We understand that Mr. Williams's furnaces have been introduced in Liverpool and Dublin with eminent success, and that within the last few months, his agents, Messrs. Dircks and Co., of Manchester, have been actively engaged in erecting them for some of the first establishments in that town, and that an experimental furnace is being constructed by them for public inspection on some vacant ground in Fennel-street, near the Old Church. In no town, perhaps, could it be more advantageously or severely tested; the smoke nuisance is there proverbial, and every scheme that has been proposed for abating it is well known there; and it is, moreover, the home of one of the most illustrious chemists of the age—the venerated Dr. Dalton, so happily styled by Dumas, "the Nestor of the physical sciences."

## COMMON ROAD STEAM TRAVELLING.

Sir,—In a recent number you have noticed the good performance of Mr. Hill's steam carriage on common roads, but you sum up by remarking that the *cost* of traction is yet a mystery to the public. I am very far from blaming you for any such doubt, but I trust that you will not question the correctness of the statement I have given, or rather that engineers and reporters of the public press have often given, of the coke consumed by the steam carriage constructed by Mr. Squire and myself, and which travelled every day from Paddington, or the Regent Circus, during eighteen consecutive months, to Harrow on the Hill, Watford, Edgeware, &c., at the rate of fifteen to twenty miles the hour, without any repairs to the engines or boiler.*

On the road to Edgeware there is a public-house called the Welsh Harp, which is six miles from our factory.

* "Every day for eighteen consecutive months without any repairs, &c."! It is a pity so really clever and deserving a person as Col. Maceroni, should spoil a good case by the repetition of such extravagant statements. Ed. M. M.

Long journeys requiring stations for coke and water, and many persons being pressed for time, we very frequently confined ourselves to that trip of twelve miles, and on our return often found another batch of visitors to take out again.

Now Mr. Alexander Gordon, Mr. Hullmandel, the Marquis of Tweedale, Mr. John M'Neil, and fifty other gentlemen, do well remember that on such *one-fire* trips, as we called them, we used *only one sack* of coke, at the *London* price of two shillings a sack. The fire being made up, we started, putting the remainder into the coke-box at the back of the carriage. We ran the six miles and back again, then several times round Paddington Green, and then, generally, down the Edgeware Road to Oxford-street and back, with as good a fire as when we went out. This distance, fifty times thus performed, cannot be estimated at less than fifteen miles the hour, with two shillings' worth of coke; but if we put it at only twelve miles, *it comes to only two pence a mile*, besides a full fire puffed out on our return to the yard. I only venture to trouble you with this statement of that which has been witnessed and tested by hundreds of the most respectable and competent persons, as a simple reply to your remark on the *cost* of steam travelling on our common roads.

The only repairs I ever had to make were of ill-welded axle-trees, which the use of a tilt-hammer has now done away with.

I should not forget to state that an *official* report was made by a committee of engineers, ordered by the French government to ride in my carriage, (surreptitiously taken to Paris,) so as to ascertain its safety, speed, expense, &c., from which Report, the following is a brief extract:—

"We have shown that Colonel Maceroni's carriage consumes 270 kilogrammes of coke, running nine post leagues of 2,000 toises each. About 70 kilogrammes are used to get up the fire; remain 200 kilogrammes, of which twenty may be called wasted at the stations, taking in water in *the present* slow way. So taking all things into account, the carriage requires 20 kilogrammes per league, say 23, and we shall have an expense of one franc of coke per league, at the high Paris price of that fuel.

"The weight of Colonel Maceroni's carriage, when charged with its stock of coal and water, is as follows.

| | Kilogr. |
|---|---|
| Empty carriage, boiler engines, &c. | 2250 |
| Water in the tank and boiler | 400 |
| Coke in coke-bag and furnace | 100 |
| Fifteen persons | 1050 |
| Baggage of passengers | 250 |
| Total | 4050 |

"This carriage, constructed in England, for good well-kept roads, does not appear *to us* to be sufficiently suspended for our rough-paved roads, and it is to avoid too violently shaking the machine, that its power is here greatly restrained. Its average on the Versailles road is, watch in hand, four leagues the hour; but up the long hill of Sèvres it was allowed to go at the rate of five leagues the hour.

"After all these proofs, the problem of steam travelling on common roads is physically resolved; every body, as well as the committee, who has seen what we have for so long a period, and with only one carriage, freely allow the fact. As to repairs, we cannot speak positively; we have seen none wanted. Our only guide for a comparison is, that on the road from Paris to Bordeaux, which is the easiest and best kept in France, it costs the horse coach six francs per league, at two leagues and a half per hour, whilst we have clearly ascertained that Colonel Maceroni's steam coach costs only one franc per league. We suppose that the expense of a coachman and guard (*conducteur*) are about the same as the steerer and stoker of a steam coach.

(Signed) "SAIGEY."

So much for the expense of common road steam carriages, when of a proper and simple construction. I am now forming a Company which will show what can be done.

I have the honour to be, Sir,
Your obedient servant,
MACERONI.

September 27, 1811.

RECIPES FOR BLACKING.

Sir,—Perceiving in your Magazine, an inquiry for a good recipe for blacking, I send you the following, which will and does produce a very excellent article; but if your correspondent requires a large quantity, he can buy it both cheaper and better of the patentees, Messrs. Bryant and James, of Plymouth, than he can make it upon a

small scale, the materials being by them well sifted, mixed, and kneaded by means of steam power.

*Paste Blacking.*

| | Pounds. |
|---|---|
| Ivory Black .............. | 60 |
| Treacle .................. | 45 |
| Best Vinegar .............. | 12 |
| Oil of Vitriol .............. | 12 |

Mix well for 30 minutes; after standing 7 days, add

| | |
|---|---|
| India rubber oil ............ | 9 |

Mix very intimately.

*Liquid Blacking.*

| | Pounds. |
|---|---|
| Ivory Black .............. | 60 |
| Treacle .................. | 45 |
| Gum Arabic .............. | 1 |

dissolved in

| | Gals. |
|---|---|
| Vinegar, (No. 24.).......... | 20 |

Mix well, then add very gradually

| | Pounds. |
|---|---|
| Oil of Vitriol .............. | 24 |
| India Rubber Oil .......... | 9 |

Mix half-an-hour daily for a month.

After being allowed to stand 14 days add 3lbs of gum Arabic in powder.

*India Rubber Oil.*

India rubber in very small pieces, 18 ounces. Rape oil 9lbs. Dissolve in a water bath.

*A good article for family use can be prepared thus:*

| | Ounces. |
|---|---|
| Ivory Black ................ | 3 |
| Treacle .................... | 2 |
| Oil ......................... | 0½ |
| Vitriol ..................... | 1 |
| Vinegar .................... | 16 |
| Gum Arabic ................ | 1 |

Mix well.

STYX.

THE "LITTLE WESTERN."

Sir,—I was in error in stating the *Little Western* to be an iron boat; she is of wood, built with diagonal iron bracing. Her engines, built by Acramans, Morgan and Co. of Bristol, are of a peculiar form; the cylinders are horizontal, with vertical beams, and worked by two tubular boilers. The steam pressure will be from ten to fifteen pounds on the square inch; the decorations of her cabins are got up in an exceedingly elegant style, and she is fitted with Morgan's paddles. In fact, every effort has been made to render her worthy of the river on which she is intended to ply. She will draw but 3 feet of water, which is very little for a boat of her size. I have noticed a letter by a correspondent "Rufus," whose views entirely coincide with mine with regard to the mystification about the machinery, &c. of the new steamers on the Thames. There certainly may not be more danger with high-pressure steam than with low, when proper precaution is used, but any concealment always gives one a feeling of distrust.

Thanking you for inserting my last communication in your truly valuable journal, I am, Sir,

Your most obedient servant,

A MECHANIC.

September 27, 1841.

BALLOONING AND STEAMING IN CONJUNCTION.

Sir,—Will some one of your learned correspondents have the goodness, through the medium of your instructive publication, to inform the writer, wherein consists the impossibility of the following suggestion being reduced to profitable practice? viz.

*To transport merchandize across the sea, or from one part of the Continent to another, by means of a balloon towed by a steam lighter, or a steam carriage.*

The balloon will relieve the lighter of the weight of the load and be itself guided in the required direction by the steam vessel. A fair and moderate wind, or no wind at all, is the desideratum. The suspended load to be lowered from the balloon by the aëronaut at the place of delivery, and with as little loss of gas as possible; and to be the first passenger is claimed by the projector.

Sir, I remain, yours, &c.

T. H. P.

Jersey, September 13, 1841.

A WORD OR TWO IN FAVOUR OF PADDLE-WHEELS.

Sir,—In your 945th Number, there is an attack, by Mr. T. Burstall, on the paddle-wheel, showing the loss of power to be about three parts out of four. When the writer was taking his data,

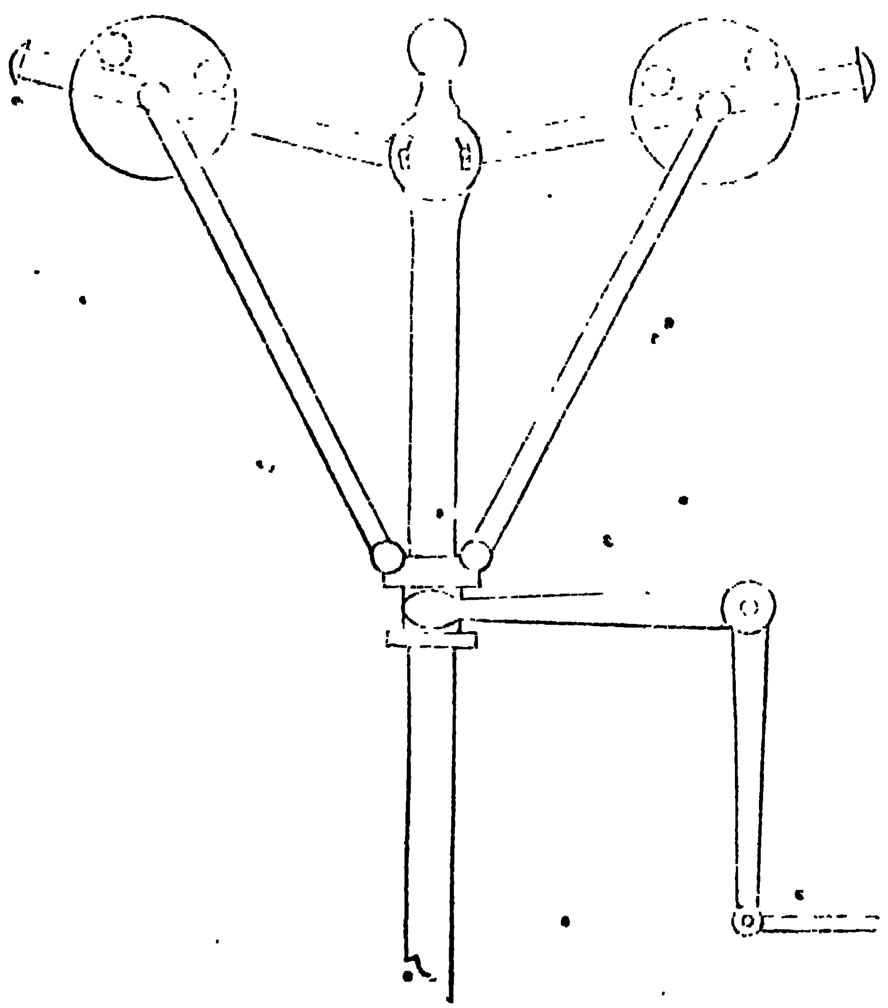
as he professes to do, from the last edition of Tredgold's work, he ought, above all things, to have taken care that the items were correct, particularly in so important a matter as the breadth of the paddle boards, which I find are 4 feet 6 inches, instead of 3 feet 4 inches. This would add 33 per cent. to Mr. Burstall's calculations, giving, even according to his own way of reckoning, 75 horse power, instead of 56, as applied in direct action in the boat. It is easy to show theoretically by an array of figures almost anything, particularly with a little management of data; but the argument is not complete until it is shown what becomes of the lost power, and that is a task for the author. The friends of the paddle-wheel may be well satisfied with its universal adoption, and with the results. When Thames steamboats run fifteen miles the hour in dead water, and packets cross the Atlantic to a day by the aid of paddle-wheels, it requires some one of more weight than the author of the article in question, and some better scheme for propelling than has yet been seen, before I, for one, shall lose my faith in the old plan.

I am, Sir, &c.

STEAM.

London, October 2, 1841.

## IMPROVED GOVERNOR FOR STEAM ENGINES.



Sir,—The description you gave of Mr. Davies's Improved Governor, in No. 934 of your interesting journal, suggested to my mind a plan of one, which I think would answer the purpose; and under the impression that the publicity of our ideas, however insignificant, may lead to some useful result, I am induced to send a description of it for the consideration of your readers.

It will be seen by reference to the prefixed sketch, that the two arms are jointed, so that they may be set to

any desired angle above a horizontal line. I am, Sir,

Yours respectfully,

L. OREAL.

Manchester, August 10, 1841.

### ON MR. SMEATON'S EXPLANATION OF MECHANIC POWER.

Sir,—When Mr. Smeaton began to examine the effects of water, applied as a moving power to water-wheels, he consulted the best authorities of the time, and met with the following discrepancy:—

Belidore made it out, that water applied by impulse had six times the effect of water acting by its gravity.

Desaguliers, on the other hand, came to the conclusion, that water acting by its gravity, had ten times the effect of water acting by impulse: so that the difference on this point, between the conclusions of these two authors, was no less than 60 to 1.

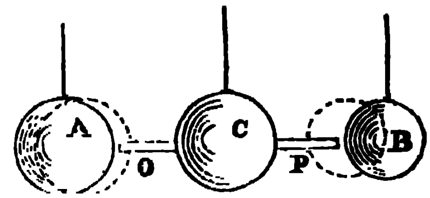
Mr. Smeaton found, that in the case of water acting by impulse on a water-wheel, a large portion of its force was expended in producing a *change of figure* in the water. This, as an effect of force, had not been duly taken into consideration by writers on dynamics; force being estimated by them only according to its effects in producing change of motion. All our notions of force appear to be derived from pressure, as it is perceived by the sense of touch.* By comparing all other pressures with the pressure of gravity, a common measure of pressure was obtained.

Mr. Smeaton considered all forces producing *change of motion*, or *change of figure*, in masses of matter, as pressures acting through some portion of space; and he held that the proper measure of such a force, consists of the pressure multiplied into the space through which it acts. This he termed *Mechanic Power*.

Observing that practical men are chiefly engaged in the application of mechanic power, to produce change of figure,† he selected various cases of the production of such effects, and of changes of motion, for the purpose of explaining his views of the proper measurement of the forces by which they are produced.

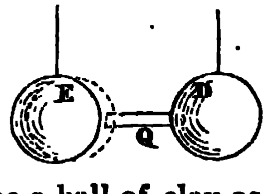
Some of these may be stated in the following way:—

Let C be a ball of clay, or any other soft and wholly inelastic substance, suspended at rest, but free to move in any horizontal direction with the slightest impulse. Let the two pegs, O and P be similar and equal in every respect, and let them meet with uniform and equal resistance in penetrating C.




Let A and B be two balls, not penetrable by O or P, and the weight of A be double that of B, and let the velocity of A moving in the direction A C, be half that of B moving in the opposite direction B C, and let A and B strike their respective pegs at the same instant.

C will remain unmoved, A and B will be brought to rest in the same time, and the peg P will have penetrated C twice as far as it has been penetrated by O. The joint mechanic powers of A and B have been expended in producing a change of figure in C, which is measured by the sum of the penetrations of the pegs O and P.

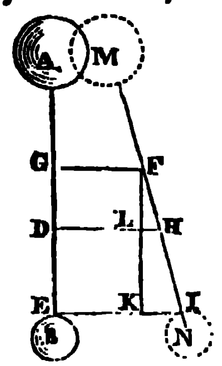



Let D be a ball of clay as before, of the same weight as A, and let E be a hard ball of the same weight as A, and let the peg Q be the same as O, and be struck by E, moving with the same velocity as A. Q will penetrate D only half as far as C was penetrated by O, and D and E will move on together with half the striking velocity of E. Here, half the mechanic power of E has been expended in producing the change of figure in D, one quarter in producing the motion in D, and one quarter remains in the motion of E.

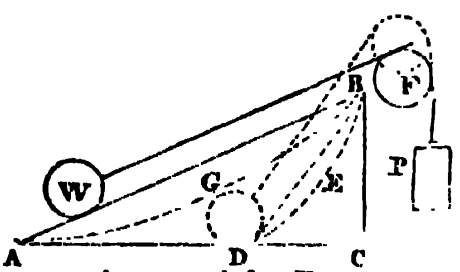
* Professor Robinson on Impulsion.

† The grinding of corn, the expressing of oil from seed, the sawing of timber, the hammering and rolling of metals, the driving of piles, the rending of rocks, the raising of weights from the ground, are all examples of mechanic power, producing change of figure.

Let G be the centre of gravity of two bodies A and B, connected by an elastic rod at rest, but free to move in any direction, and let pres-




sure be applied at D, in the direction D H, at right angles to the rod. Let E be the centre of gyration of A and B around G. Draw G F, D H, and E I, perpendicular to A B. On E I, take two points K and I, so that E K : K I :: G E : G D. Through K draw K F parallel to A B, and through F and I draw M N. Then if we take G F to represent the progressive velocity produced in G by any pressure acting at D, K I will represent the rotary velocity produced in E in the same time; and if D H represent the whole space through which the pressure has acted, D L will represent that portion of the mechanic power which has produced the progressive velocity; and L H that portion which has produced the rotary velocity, and we shall have $G F^2 : K I^2 :: D L : L H$.




Let a given weight P, connected with another W by a string passing over the pulley F, descend vertically and raise W, without friction, from the horizontal line A C, along the inclined plane A B. If we make A B : B C :: 2 W : P W will be raised to B in the least time;* and upon this principle, the maximum of effect in machines has been demonstrated in theory. In practice, however, the object is not merely to raise W to B in the *least time*, but to raise it with the least expenditure of *mechanical power*. When it is raised in the least time, P must descend through a space = A B; but when it is raised with the least mechanical power, P descends through a space = ½ A B only. For if we make B D = ½ A B, and let W ascend along any concave surface D E B, of which B D is the chord, it will be raised to B by the descent of P through a space = B D, and it will be at rest when it arrives at B. To determine the curve by which W will ascend from D to B in the least time, is, I believe, an intricate problem; but a practical approximation to it, in any particular case, may easily be found.

A well-constructed steam-engine for raising water, exhibits in every stroke a practical example of the same problem.

At the commencement of the stroke, a great pressure of steam is thrown upon the piston, and this pressure is gradually diminished, so that at the end of the stroke there is a considerable preponderance in the other direction.

In consequence of this regulated pressure of the steam, the motion of the machine, resembles the uniform vibrations of a pendulum, and the mechanic power of the steam is applied to the greatest advantage.

If we suppose three strings, A B, A C, and A M, in the same plane, to be united at A, the strings A B and A C to be prolonged to a length indefinitely great, and the end of each of the three strings to pass over a vertical pulley,—

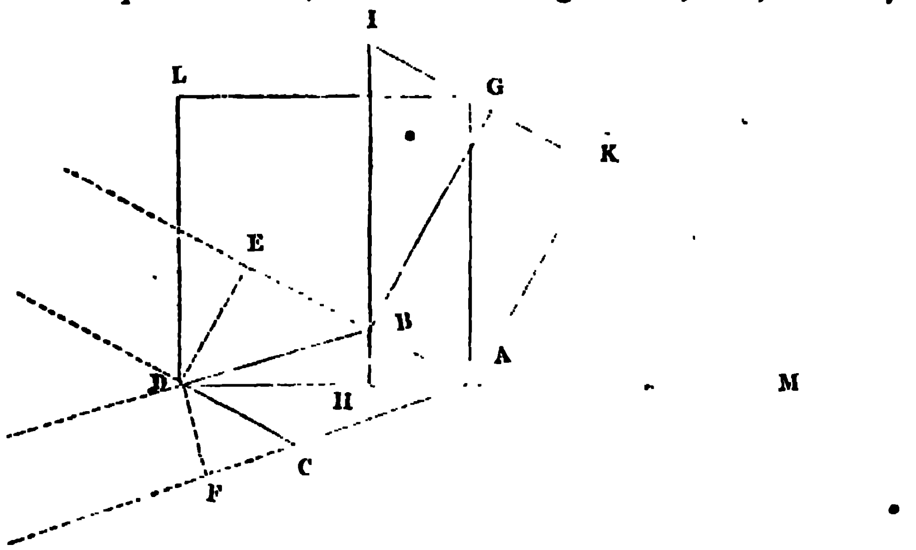
Let the parallelogram A B D C be completed, and draw D E and D F perpendiculars to A B and A C, and if three weights *m*, *n*, and *o*, be to each other as A D, A B, and A C respectively, and be suspended by the respective strings A M, A B, and A C, they will balance each other, and the strings will coincide in direction with the diagonal and sides of the parallelogram.

If the weight be set in motion, by taking from *m*, for a short time, a small part of its weight; and replacing it after all are in motion, *n* and *o* will descend, raising *m*, and the point of junction of the strings will move in the direction A D; and when that point has arrived at D, the weights *m*, *n* and *o*, will have moved through the spaces A D, A E, and A F respectively.

* If the ascent be made in the least *possible* time, W must ascend, not along the plane A B, but along a concave surface A G B.

The quantity of mechanic power in action, therefore, is on one side $m \times$ A D balanced by $n \times$ A F + $o \times$ A G on the other side; or the mechanic powers in the different directions are respectively as the square of A D, the rectangle A B, A E, and the rectangle A C, A F.

This conclusion, however, involves the geometrical proposition, that the square of A D is equal to the sum of the rectangles A B, A E, and A C, A F.




On A D describe the square D G, and through B draw H I parallel to A G; draw A K at right angles to A E and equal to A E, and draw K I parallel to A E; then D A G and E A K, being right angles, D A E = G A K, and A E D and A K G being right angles, D A E and G A K are similar and equal; therefore, A G = A D, and the parallelogram B K (A B × A E) = A I = H G.

In the same manner the parallelogram H L may be demonstrated to be equal to A C × A F.

PHILO-SMEATON.

## COMPARATIVE OBSERVATIONS ON THE PRINCIPLES OF WARMING HOUSES, CHURCHES, MANUFACTORIES, CONSERVATORIES, AND ALL EXTENSIVE BUILDINGS, BY MEANS OF HEATED WATER—BY DR. WILKINSON, BATH.

The quantity of water in pipes of different dimensions is in the same lengths proportionate to the square of their respective diameters, whilst the radiating surface is only in the simple ratio of their diameters; thus a gallon of water being equal to 231 cubic inches: supposing the thickness of metal to be ¼ inch in a 4 inch pipe, it will require 2 feet in length to hold 1 gallon.

The inch pipes employed by Perkins are of the same thickness, so that the tubular part is half-an-inch in diameter, and hence will require 49 times the length of pipe to contain 1 gallon equal to 98 feet, such being as the square of 3½ inches to ½ inch, being 49 times greater in length, whilst the surfaces exposed are only as 8 to 1, and therefore, supposing the water in each pipe be preserved at the temperature of boiling, viz., 221°, it will only require 16 feet in length of the smaller pipe to expose the same surfaces as 2 feet of the larger; it is hence evident that only ⅓d of the quantity of water is required, and a proportionate saving of metal and fuel.

In pipes of four or more inches in diameter, the boiling point of water is rarely exceeded, whilst the lowest degree of temperature in the small pipes employed by Perkins is 300°, or more than three times the heat of boiling water, and in a similar proportion the radiation of heat is increased, and with the same increased rapidity warmth is transmitted to different apartments. About two years since, I was requested by the Duke of Beaufort's agent to make some experiments on the mode there adopted for warming Badminton, and we could not succeed in raising the temperature in the library and the conservatory more than 10°; this apparatus was removed, and the small pipe system adopted, every required warmth is now obtained, with less than ⅓d of the fuel before used. A similar case occurred in a large room at the British Museum, which I visited with Mr. Perkins; the large pipes, being found inadequate, were removed, and, I was informed, weighed more than 7 tons, whilst a superior heat was transmitted by the employment of only 15 cwt. of small pipes.

There is also a material difference in the time required for the distribution of heat; many hours are necessary for the production

of that temperature by large pipes, which is accomplished in one hour by small pipes.

In some situations pipes pass through cold passages, and in intense weather subject the water to be frozen, in consequence of which, the circulation being prevented, the pipes in the furnace become softened, and give way to the pressure of the heated fluid; the water is converted into expansive steam, and if, as occurred last winter in Manchester, the furnace is imprudently placed in a depôt of combustible materials, danger is incurred; the warming apparatus in this case appears to have been very indifferently arranged, and not under the direction of the patentee, Perkins. To guard against any such results, Mr. Perkins attaches to his apparatus a safety valve, and when high heat is employed, all danger from obstructions of the kind are most effectually prevented.

It appears that the fire took place on a Monday, so that during a very intense frost, the fire was extinguished for two nights and a day, while, if a gentle combustion had been preserved in the furnace during that time, sufficient heat would have been produced to prevent any freezing result. In my own residence I have adopted Mr. Perkins's plan, and by means of a single coil of pipes in the entrance passage, during the last inclement winter, at an expense not exceeding sixpence per day, sufficient heat was radiated from the single coil, so that every room in the house was at a temperature between 50° and 60,° and it will give me at all times great pleasure to show and to explain the principles of the apparatus to any person desirous of introducing into their house this most agreeable, and, in my opinion, perfectly secure mode of warming their houses.

I have no comparative observation on the employment of heated air—on every principle the effects are not only unpleasant, but also injurious. W.

## ON LEAD SHEATHING FOR SHIPS. BY MR. J. J. WILKINSON.

[From the Trans. of the Soc. of Civ. Eng.]

The commencement of this communication, which is the continuation of the paper on the "Wood Sheathing of Ships," which was read March 23d (page 236), examines in great detail the various uses to which metals were put in the earliest period of which any record exists, and then it traces the first application of lead to the protection of shipping.

There are very early instances of ships and vessels being covered with lead.

In the 15th century, a boat, 30 feet in length, was found in the Mediterranean sunk in 12 fathoms water; it was built of cypress and larch. The deck was covered with paper and linen, and over all with plates of lead, fastened with gilt nails; this covering proved so impervious to moisture, that parts of the interior were perfectly dry. It is supposed to have lain there above 1,400 years.

A Roman ship was also found sunk in the Lake of Nemi. The hull was of larch; bitumen had been applied to the outside, over which was a coating of a reddish colour, and the whole covered with sheets of lead, fastened by gilt nails. The interior had a thick coating of cement made of iron and clay. The seams of the planks were caulked with tow and pitch.

Some of the ancient domes at Ephesus were sheathed with lead, and it appears that the column of Constantine at Constantinople, was formerly covered with that metal.

It is certain that lead mines were worked in Britain by the Romans; and long before the Conquest, plates of lead were used as coverings for ecclesiastical buildings. These coverings being designed to endure, were of very thick lead.

In 1231, water was brought from Tyburn to London in pipes; but the material of the pipes has not been ascertained. In 1285, the great conduit in Cheapside was supplied with water conveyed through pipes from Paddington; these pipes are expressly stated to have been of lead. It has, however, been averred, that the lead pipes for conveying water were first introduced by Robert Brook, in the reign of Henry the Eighth.

Sheet lead was used in Spain and Portugal for sheathing ships, and for covering the rudders, long before it was employed in England. It was used in Holland in 1666, and at Venice in 1710.

It is probable that we are indebted to Sebastian Cabot for its introduction into England; it is stated in his memoirs that he first saw it used in 1514; he was then in the service of the king of Spain, which he entered in 1512, and was appointed pilot major; he afterwards returned to England, and in 1553 was named by Queen Mary, "Governor of the Mysterie and Company of Merchant Adventurers, for the discovery of Regions, Dominions, Islands, and Places unknown."

Three vessels were fitted out for this purpose, under the command of Sir Hugh Willoughby, one of which was sheathed, or at least partly so, with thin plates of lead, then first mentioned as an "ingenious invention." This expedition was unfortunate—Sir Hugh Willoughby, with the crew of two of his ships, being frozen to death; one of the commanders, and his crew, alone escaped. This expedition was the origin of the trade to Russia, and of the Spitzbergen Whale Fishery.

In the reign of Elizabeth a patent was

granted to one Humphrey, for melting lead, but was afterwards recalled, the plan not being new.

It appears that up to about 1670, cast sheet lead was used for sheathing; at that time milled lead was invented, and a patent for milling lead was granted to Sir Philip Howard and Francis Watson; by this process the inequalities, as well as the defects from air holes, in the former mode of manufacture, were remedied; the whole surface was rendered smooth and uniform, and the weight greatly reduced. This invention met with much opposition from the plumbers, who averred that it could not be durable; an offer was therefore made on the part of the Milled Lead Company, to keep in repair during forty-one years all milled lead of the weight of 7lbs. per square foot, at the rate of five shillings annually per each hundred pounds' worth in value.

One of the earliest vessels in the Royal navy thus sheathed, was the *Phœnix*, a fourth-rate. This was done at the express command of Charles II. This vessel made two voyages to the Straits, apparently for the express purpose of testing the new invention, and on her return in 1673, was careened at Deptford, and personally inspected by the King. An order was then issued that his Majesty's ships should in future be sheathed only with lead, excepting by especial order from the Navy Board. It appears that about twenty ships of the royal navy were consequently sheathed with milled lead, and fastened with copper nails.

Even the royal protection could not save this invention from cavillers, so that, in 1677 and 1678, complaints were made by Sir John Narborough, and Sir John Kempthorne, that the rudder irons of the *Plymouth* and the *Dreadnaught* were so much eaten, as to render it unsafe for those vessels to proceed to sea; these complaints were repeated in 1682.

The patentees maintained, on the contrary, that the damage to the rudder irons could not possibly arise from their being covered with lead, as it had been the invariable practice for a great many years, to secure the iron work of ships generally, by lead covering, and especially by capping the heads of their bolts, under water, with lead, seized to and nailed over them. Reports too, in favour of the invention, were made by Sir Phineas Pett, and by Mr. Betts, master builder, at Portsmouth, in which the latter stated, that lead had effectually prevented the vessels becoming what is technically termed "ironsick," meaning that the bolt-holes became so widened by corrosion, that the bolts were loosened; he recommended, however, that the lead sheathing should be stripped every seven years, on account of the decay of the oakum in the joints; declaring too, that it became less foul on the voyage than wood sheathing, and was much more easily cleaned. These different opinions led to the issue of an Order in Council in 1682, for the appointment of commissioners to examine and report upon the alleged injury to the iron work by milled lead covering. It is probable their report was unfavourable, as it is said that the use of lead covering, fastened with copper nails, was abandoned on account of the rapid corrosion of the rudder irons. A controversy appears to have arisen on this subject, the merits of which it would be difficult to ascertain after such a lapse of years. Government, however, subsequently determined to make another trial of the value of lead covering; accordingly, the *Marlborough* was so sheathed, and laid up in ordinary at Sheerness. A few years after she was docked at Chatham, in 1770, when it was found that the lead sheathing was covered with weeds, and the iron fastenings very much decayed; the lead was in consequence removed, and a wood sheathing substituted.

Several patents were afterwards obtained for different mixtures of metal for this purpose, none of which seem to have succeeded, being all subject to the same inconveniences as the simple metal; among which was the influence of the sun in the torrid zone, which was said to reduce the lead, in the course of five or six years, to a calx.

Among these patents for mixed metals for sheathing, is mentioned that of Mr. Bulteel, in 1693; it was found to have all the inconveniences of lead. Mr. Donithorne, in 1780, obtained a patent for sheathing, of a mixture of 112 parts of tin to 10 parts of zinc; this was also as objectionable as lead.

Slade's patent for sheathing with copper laid upon lead, and the patents of Wetterstedt, and of Muntz, for mixed metals, are examined; and the author promises a continuation of the subject, with the history of copper sheathing.

## ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

*⁂ Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for that purpose.*

MOSES POOLE OF LINCOLN'S-INN, MIDDLESEX, GENTLEMAN, *for improvements in stretching cloths.* (A communication.) Enrolment Office, September 22, 1841.

A revolving frame is employed, composed of two side framings, each of which carries a spiral projecting plate, or surface

covered with points, which take hold of the selvage of the cloth. The side framings are mounted on a horizontal axis, one of which is fixed to it, and the other capable of sliding along it, in order to receive the cloth in its narrowest state, and afterwards stretch it in width by its sliding movement. A bar extends from one side framing to the other, and is provided with a number of hooks, on which one end of the cloth is put, on first introducing it into the machine, in order to keep it even. The cloth to be stretched is first wound on a roller mounted in a suitable frame, a bar with hooks being fixed on the roller, to keep the cloth even, both in winding and unwinding, and to prevent its being unequally dragged by the revolving frame. From this roller the cloth passes between a pair of small rollers (the uppermost one of which is weighted,) and is thence conducted over a circular brush (or a roller covered with a suitable adhesive surface,) to the revolving frame.

The claim is to the mode of constructing a machine for stretching cloth.

JOSEPH WRIGHT OF CARISBROOK, ISLE OF WIGHT, MECHANIC, *for improvements in apparatus used for dragging or skidding wheels of wheeled carriages.* Enrolment Office, September 22, 1841.

The skid-pan is linked to the lower end of a rod, which moves on a pin joint at its upper end in front of the hinder axle, and at the point of attachment to the skid-pan the drag chain is fastened. The other end of the drag-chain terminates in a link connected with an apparatus, so that it is held securely while dragging the wheel, but in unskidding it the chain is set free, and the wheel passes over the skid-pan.

The apparatus connected with the link consists of a bar affixed to the fore-carriage, the point of which bar is formed into a curved projection which holds the link: for releasing the same, a forked lever embraces the curved projection, being actuated by a rod which terminates in a handle by the coach-box.

After the wheel has passed over the skid-pan, the link of the drag-chain is drawn back over the covered projection by a chain, while a second chain, attached to the rod, draws the skid-pan forward, and raises it in front of the hind wheel in readiness for future use.

The claim is to the mode of applying skidding or dragging apparatus to the wheels of wheeled carriages, whereby, in unskidding the same, the skid-pans are allowed to pass under the wheels, by releasing the drag-chain as described.

The principle of this patent is identical with the plan suggested nine years ago by Mr. Baddeley, at page 105 of our 18th volume, although the mode of carrying it into effect is, no doubt, novel.

ACHILLE ELIE JOSEPH SOULAS, OF GEORGE YARD, LOMBARD-STREET, MERCHANT, *for improvements in apparatus for regulating the flow of fluids.* (A communication.) Enrolment Office, Sept. 22, 1841.

These improvements are particularly adapted to regulating the flow of gas for the purpose of illumination, and our readers will at once perceive their close resemblance to the "Gas Moderator," patented some time since by the Rev. H. F. Bacon, and described in our pages. In the present plan, a disc is placed within a cylinder, leaving a space for the passage of the gas, the space and the weight of the disc being so adjusted to the pressure required, that upon any increase of pressure the disc is raised. A rod which is fixed in the centre of the disc rises with it, and diminishes the size of the orifice through which the gas passes, in an inverse ratio to the pressure, by which means an equilibrium ensues, and the flow becomes uniform. Other modes are suggested as available for the same purpose; thus, a conical rod may work through a circular opening, or it may terminate in a small disc, moving in a conical passage.

MORRIS WEST RUTHVEN, OF ROTHERHAM, YORKSHIRE, ENGINEER, *for a new mode of increasing the power of certain media, when acted upon by rotatory fans, or other similar apparatus.*—Enrolment Office, September 22, 1841.

The mode here patented consists in causing air, water, or other fluids to pass through a series of revolving fans, so arranged that each succeeding fan acts upon the media which has been acted upon by the previous one, and, increasing its power, (?) forces it through the exit passage of the last fan of the series with the accumulated force of the whole, in the form of a strong jet, or blast.

The claim is, to the mode of increasing the power of the said media, when acted upon by rotatory fans, or other similar apparatus, by causing it to pass directly from one set of fans to another, throughout the whole series, each succeeding set of fans acting upon it in the state in which it left the preceding set, in consequence of the eduction passage for the air from one set of fans forming the induction passage of the succeeding set of fans.

DAVID NAPIER, OF MILL-WALL, POPLAR, ENGINEER, *for improvements in propelling vessels.*—Enrolment Office, September 22, 1841.

These improvements are two in number. The first consists in using two propellers of equal diameter at the stern of the vessel,

their axes being above the water, but one further aft than the other, so as to allow the float-board of one wheel to work nearly up to the axis of the other, and at the same time to work clear of the other wheel. These wheels have the float-boards placed obliquely, and work at right-angles to the direction of the vessel.

The second improvement consists in connecting the float-boards to a metallic frame, the weight of which keeps the floats in a vertical position. For this purpose the floats are mounted on axles, the ends of which are cranked, and the frame being suspended from these cranks constantly preserves the vertical position of the float-boards.

ROBERT GOODACRE, OF ULLESTHORPE, LEICESTERSHIRE, GENTLEMAN, *for a mode of weighing bodies raised by cranes or other elevating machines*. Enrolment Office, Sept. 22, 1841.

The body to be weighed having been lifted to the requisite height by the chain of a simple crane, it is transferred to a grappling-iron suspended by loops and centres from the end of a lever, the fulcrum of which works in a cup affixed to the end of the crane-jib. The long arm of this lever reaches to a line raised perpendicularly from the foot on which the crane turns, where it is attached to an upright rod, the lower end of which is connected to a second lever, rather shorter than the first, the fulcrum of which turns in a bearing placed above it. The upright rod is attached to the short lever between its fulcrum and a counterpoise weight, which keeps the lever in a horizontal position; the long end of the lever is divided into a scale, upon which the counterpoise is shifted until the weight of the body is ascertained. By this arrangement alone, however, any body under a given weight would be more than counterbalanced; to ascertain, therefore, the weight of lighter bodies, a steel cup is placed under the short lever, on the opposite side of the connecting rod to that on which the cup is fixed above the lever, and in this cup a centre attached to the lever works, serving as a fulcrum to it. The short lever is heavy enough on one side of its fulcrum to balance the weight of the connecting-rod and upper lever, so that a small weight hung on the end of the upper lever throws it off its balance, and produces a movement of the lower lever.

The foregoing arrangement may be modified to render it applicable to all the different kinds of cranes.

ROBERT COOK AND ANDREW CUNNINGHAM, OF JOHNSTONE, NEAR GLASGOW, ENGINEERS, *for improvements in the manufacture of bricks*. Enrolment Office, September 22, 1841.

A sliding mould frame, containing two moulds, is applied to each side of a common pug-mill. A box is bolted to the mill, around the opening in its side, into which the brick earth is forced by the rotation of the curved arms attached to the axis of the mill. A piston working in the box then presses the earth into one of the moulds in the sliding frame, which has been placed to receive it. The sliding frame is supported upon two beams, one of which is bolted to the side of the pug-mill, while the other is supported by a bracket, which also serves as a bottom to the moulds while the brick earth is being pressed into them. When one of the moulds has been charged with brick earth, the frame is moved forward, which brings the other mould under the box, while the full one is carried over an empty moveable mould placed on a table. While the frame is thus moving, the piston is raised, and a fresh supply of brick earth is forced into the box; when the frame stops, the piston descends and fills the mould, a discharging piston at the same time pressing the brick earth out of the first mould into the moveable mould on the table, the piston rising immediately, so as not to impede the shifting of the frame.

In this manner a continuous movement is produced, one mould being discharged while the other is filling. A boy attends to the moveable mould, discharging the brick on to a pallet, and replacing the mould on the table.

The claim is, 1. To the mode of combining the use of moveable moulds with sliding moulds, as described. 2. To the mode of applying a fixed surface in combination with sliding moulds, as described.

ROBERT WALTER WINFIELD, OF BIRMINGHAM, MERCHANT AND MANUFACTURER, *for certain improvements in or belonging to metallic bedsteads, a portion of which may be applied to other articles of metallic furniture*. Enrolment Office, September 22, 1841.

These improvements, which are threefold, consist,—

Firstly, in improved modes of constructing the connecting joints of metallic bedsteads, and other framed metallic furniture. Various modes of construction are described and shown, which will be very well illustrated by the following description of one of them, which is a connecting joint with wrought-iron corner pieces, adapted to solid frames and pillars.

Two sides of each pillar are forged into two flat surfaces, at right angles with each other, to receive the horizontal rails. The rails are iron rods, with a lateral feather extending nearly the whole of their length, forming the sacking flange. Each end of the flanged iron is forged to a flat surface, to fit against the

faces of the pillars, the ridges of which keep it steady after it has been fastened by screws passing through holes in the pillars, and screwed into the solid metal of the horizontal rails.

Secondly, in certain new methods of stretching or arranging the sackings, or substitutes for sackings, in metallic bedsteads.

The four sides of the bedstead are formed of the flanged rods before described, and at each end of the frame, (parallel with and close to the flanged rods,) is a roller, the axis of which turns freely in the side rods. A tension-rod, the ends of which are formed into stout rings, and are passed down over the pillars, rests upon collars forged upon the pillars.

Two of the pillars, those at the foot of the bedstead for instance, are divided near the middle into two parts, the upper part terminating in a male, and the lower portion in a corresponding female screw. The tension-rod being lifted off the divided pillars, is passed through a loop formed along one end of the sacking, and then replaced. The sacking is passed under the end flanged rod, and over the roller to the other end of the bedstead, where it is led over the other roller, under the end rod, up to the tension-rod, to which it is strained and made fast by straps and buckles, forming a substitute for the ordinary head and foot boards. The sacking is then strained transversely, and secured to the side-rods by straps and buckles, after which the screws of the divided pillars are turned by a spanner, which raises the tension-rods and gives a final strain to the sacking.

Thirdly, in certain improvements in the construction of castors for metallic articles of furniture.

A revolving dome-shaped frame has at the lower part of its interior an annular plate, in which the vertical pins or axes of three or more castors are inserted. Through the top of this dome a strong screw passes, which is screwed into the solid metal of the pillar or leg of the furniture.

THOMAS WRIGHT, OF CHURCH-LANE, CHELSEA, LIEUTENANT IN H. M. NAVY, *for certain improvements applicable to railway, and other carriages.*—Petty Bag Office, September 22, 1841.

The first improvement consists in an arrangement of breaks and sledges for the purpose of stopping or retarding railway carriages. To each of the wheels of the carriages two iron sledges are applied with flanges on their soles, which fit both sides of the rail. These sledges are suspended by rods from a point above the centre of the wheel, with a pin and box, so that when the rods form equal angles with a vertical line drawn through the point of suspension, both sledges are clear of the rails. The sledges are applied by means of a connecting rod, attached at its upper end to a sliding frame placed beneath the body of the carriage, the front or hind sledge being applied according to the direction in which the sliding frame is moved. The hind sledges are applied to the wheels when the carriage is to be retarded, but if it is desired to stop the carriage, the front sledges are applied. When the sliding frame is moved half the length of its traverse, both sledges are lifted clear of the rails.

When the sledge is applied to an ordinary carriage, it is jointed to a curved rod in front of the wheel, and to a diagonal rod, by which it is applied to the wheel. The upper part of the curved rod slides in a groove in the hinder part of the splash-board, and acts as a guide to the sledge; the upper end of the diagonal rod is connected to a crank under the box of the carriage, worked by a lever, the handle of which may be worked by the driver, or by the person within the carriage.

The second improvement consists in a new mode of constructing axle-trees and boxes. The axle-tree has a double collar which fits the interior of the inner end of the nave. A spiral groove winds round the axle-tree from one end to the other, which, when the nave rotates, draws the oil from a box at the outer end of the nave, and lubricates the nave and axle-tree. Four slide-plugs are fitted in the nave, surrounding the space between the collars of the axle-tree, and receiving motion through four screws, which work in a ring on the inner end of the nave, the ends of the slide-plugs corresponding with the shape of the axle-tree. When these slide-plugs are screwed home, they fit close round the axle-tree, and hold it in its position in the nave. A spring washer is placed between the plugs and the outer collar of the nave, having four springs, which, being acted upon by the plugs, keep the washer close to the outer collar as it revolves with the nave; this washer is for retaining the oil, and diminishing friction.

The third improvement relates to an improved method of constructing carriage springs. These springs are composed of a series of steel plates, like those at present employed, but each plate is a curve greater or less than the preceding one, and capable of acting independent of the rest. In these springs, which are connected only at the part where they are attached to the carriage, the weight is brought on to the several plates of the spring in succession, the outer plate receiving the weight first, and the other plates being acted upon in succession, one after the other, according to the weight to be supported.

The fourth improvement consists in form-

ing a double, or safety flange, on the outer edge of the ordinary flange of railway wheels, by which a greater obstruction is presented to the wheels running off the rail.

The fifth improvement consists in the use of steel tubes for the shafts and spokes of railway carriage wheels; the spokes are filled with cotton, tow, or other soft substance, and are set in the naves and felloes in the usual manner.

The sixth improvement consists in the application of an elastic plate or bar to railway carriages, which may serve as a break, a sledge, and a buffer. This plate is hinged to the sliding frame described in the first improvement, and passing over the periphery of the hind wheel, is held up by a bracket so as not to touch the upper part of that wheel, nor the under part of the front wheel of the next carriage, when they are separated to the full extent of their coupling chain. To bring the bar into action, the frame is slid by suitable mechanism, so as to bring the point of the plate under the front wheel of the second carriage, which, ceasing to revolve, will by its pressure, cause the upper part of the plate to press on the upper periphery of the hind wheel of the first carriage. As soon as the momentum of the carriages is overcome, the elasticity of the spring plate will push back the hindermost carriage to its former position.

This improvement is also applicable to common four-wheel carriages.

JOSHUA FIELD, OF LAMBETH, ENGINEER, *for an improved mode of effecting the operation of connecting and disconnecting from steam-engines the paddle-wheels used for steam navigation.* Rolls Chapel Office, September 22, 1841.

This is proposed to be effected by giving a sliding motion endways to the paddle-shaft. The neck of the paddle-shaft is made considerably longer than its lower bearing brass, but the upper brass exactly fits the space between the shoulders of the neck, and, when it moves, carries it with it.

The upper brass slides endways in a cap above it, and has a recess in its upper part to receive an eccentric on the lower end of a vertical shaft, which passes up through the cap and terminates at top in a toothed wheel, to which motion is given by means of an endless screw. The axis of this screw is provided with a handle, on turning of which the toothed wheel and eccentric are put in motion, which causes the upper bearing-brass and the paddle-shaft to slide horizontally endways, and withdraws its crank from the crank-pin of the driving-shaft, thereby disconnecting the paddles from the engine. On giving a reverse movement to the handle, the paddles can be re-connected.

The paddle-shaft is retained in its position by means of palls. The mechanism for giving the end motion to the paddle-shaft may be varied, but the patentee prefers the above arrangement.

RICHARD BARNES, OF WIGAN, LANCASHIRE, ENGINEER, *for certain improvements in machinery or apparatus for raising or drawing water or other fluids.* Petty Bag Office, September 22, 1841.

This apparatus consists of a pump similar to the beer-engine, and is proposed to be used for various domestic purposes. The working barrel of the pump is surrounded by a square or cylindrical casing, which is attached to it by screws. The working barrel has a close top, and is screwed down upon a flange fitted with a valve, beneath which is affixed the feed-pipe. An ordinary valved pump-bucket works in the barrel, its rod being attached by connecting links to the handle lever. A cross head on the top of the bucket-rod works in, and is guided by, two parallel grooves, fastened to the barrel by flanges at their lower ends, and to the inside of the outer casing by ears at their upper ends.

On working the pump, the liquid flows out of a spout leading from the upper part of the barrel.

The claim is to the novel and peculiar construction, combination, and arrangement of the machinery or apparatus for drawing water or other fluids, as described.

ANTHONY THEOPHILUS MERRY, OF BIRMINGHAM, REFINER OF METALS, *for an improved process, or processes, for obtaining zinc and lead from their respective ores, and for the calcination of other metallic bodies.*—Enrolment Office, September 22, 1841.

The first improved process consists in the application of the heat generated by coke-ovens to furnaces, &c., suitably constructed for calcining, roasting, and smelting the ores of zinc and lead.

The second improvement, which is in the mode of calcining metallic bodies, is as follows. If sulphuret of zinc is to be operated upon, the impure ore is coarsely powdered, and well washed; it is then calcined in a reverberatory furnace, the heat being slowly applied for the first six hours, after which it is increased to a strong red heat which is kept up for 18 hours, the ore being stirred every half-hour. At the end of 24 hours the sulphuret will have become decomposed, and an impure oxide of zinc will be formed.

When the carbonate of zinc is to be operated upon it is to be powdered and washed, like the sulphuret, and then exposed to a strong red heat in a reverberatory furnace for five or six hours, being stirred occasionally, when the carbonate will be converted into an impure oxide of zinc.

In using the coke-oven a fire is made in it,

and small quantities of coal added until the subliming pots become red hot by the action of the flames, &c, which pass into the subliming furnace by the flue, and from thence through the reverberatory furnace into a large chimney. The refuse coal being cleared out of the oven, it is charged with the coal to be converted into coke, the subliming pots being at the same time filled with the oxide of zinc mixed with powdered charcoal, or other carbonaceous substance, in the proportions of one part by weight to three parts by weight of the oxide. The conversion of the coal into coke will be completed in about 24 to 30 hours, by which time the ores will also have been reduced and the zinc sublimed. The coke oven and subliming pots are then cleared out and recharged, and the same process repeated.

A calcining furnace is shown in the specification, connected with the coke-oven by a flue.

In melting lead ores the ordinary furnace is employed, and connected with the coke-oven flue as before described.

The claim is, to the application of the heat arising from the carbonization of pit-coal to the calcining, subliming, or smelting the ores of lead or zinc, let the apparatus or process combined therewith be what it may. Also the combination of furnaces for the calcination of the ores of other metallic bodies, besides those of zinc and lead.

EDWARD FINCH, OF LIVERPOOL, IRONMASTER, *for improvements in propelling vessels.* Enrolment Office, September 25, 1841.

The propellers, in this case, consist of two sectors of a circular plane, set at an angle of 60° across the main shaft of the steam-vessel, so that the propellers will be horizontal when the crank is in a vertical position. By this arrangement, the propellers are out of the water while the engine is in its least powerful position, but by the time the piston gets to the middle of its stroke, one of the sectors will have made half its passage through the water. The vessel is thus propelled by a succession of efforts as the main shaft revolves.

When the vessel is sailing, and the propellers not required, the engine is stopped at the end of its stroke, when the crank is vertical, and the propellers horizontal above the water, and therefore presenting no impediment to the progress of the vessel.

The claim is to the mode of applying propellers (portions of a plane) across the main shaft of a steam-vessel, in such a manner, that they are horizontal or nearly so, when the crank or cranks are in a vertical position, and thus propelling the vessel by a succession of efforts.

GOLDSWORTHY GURNEY, OF BUDE, CORNWALL, ESQUIRE, *for certain improvements in the production and diffusion of light.* —Enrolment Office, September 25, 1841.

The first of these improvements has for its object to improve the illuminating power of gas, and at the same time to reduce the heat given out in burning. For this purpose 5 parts of muriate of zinc, 2 parts of subacetate of lead, 2 parts of chloride of baryta, and 4 parts of sulphate of manganese are mixed together, and used either dry, or slightly moistened, in a vessel similar to that employed for purifying gas by the dry lime process. This vessel is attached to the gas supply pipe, so that the gas may pass amongst, and be acted upon by the mixture, before it reaches the burners.

The second improvement consists in the use of a double reflector placed about the middle of the flame, so as to deflect the light both upwards and downwards in quantities proportioned to its position with respect to the length of the flame. Upon the reflector is placed a ground glass shade, which surrounds the flame, and has within it a refracting zone, consisting of a cylinder of glass cut on the outside into prismatic rings, projecting at such angles as to give the light any required direction. This zone may be used separately, or in combination with the ground glass refracter.

The third improvement relates to a mode of lighting by means of peculiarly constructed burners and glass chimneys.

The burner is composed of a number of concentric tubes, the upper surfaces of which are perforated, and connected together by the supply tubes of the gas. A conical-glass chimney surrounds the lower portion of the flame, the upper opening of which is larger than the outer ring of the burner, and there is an open space around the flame between this glass and the upper one, which is in the form of an inverted cone.

The claim is—1, To the mode of treating coal gas in its passage from the gas main to the burner or burners.

2. To the mode of applying intermediate reflectors, of the length of the flame, and also combined therewith, and placed thereon, a ground glass shade, or a refracting zone, or both together.

3. To the mode of lighting apartments or rooms by means of burners, composed of concentric rings of tubes, combined with suitable glass chimneys.

4. To the mode of applying conical glass chimneys to gas burners.

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# Mechanics' Magazine,

## MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 949.] SATURDAY, OCTOBER 16, 1841. [Price 3*d.*

Edited, Printed and Published by J. C. Robertson, No. 166, Fleet-street.

## KENDALL'S RAILWAY CONNECTING AND DISCONNECTING APPARATUS.

Fig. 1.

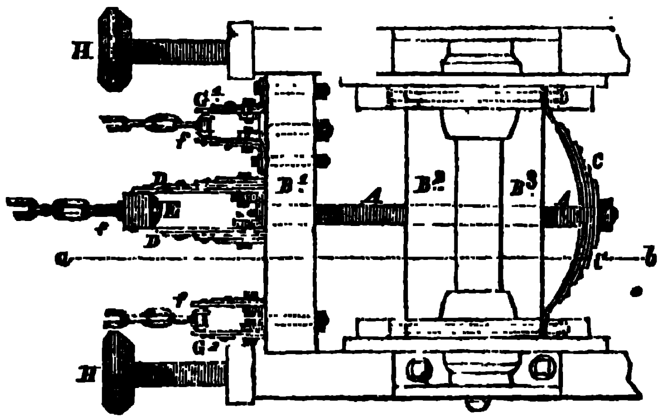


Fig. 5.

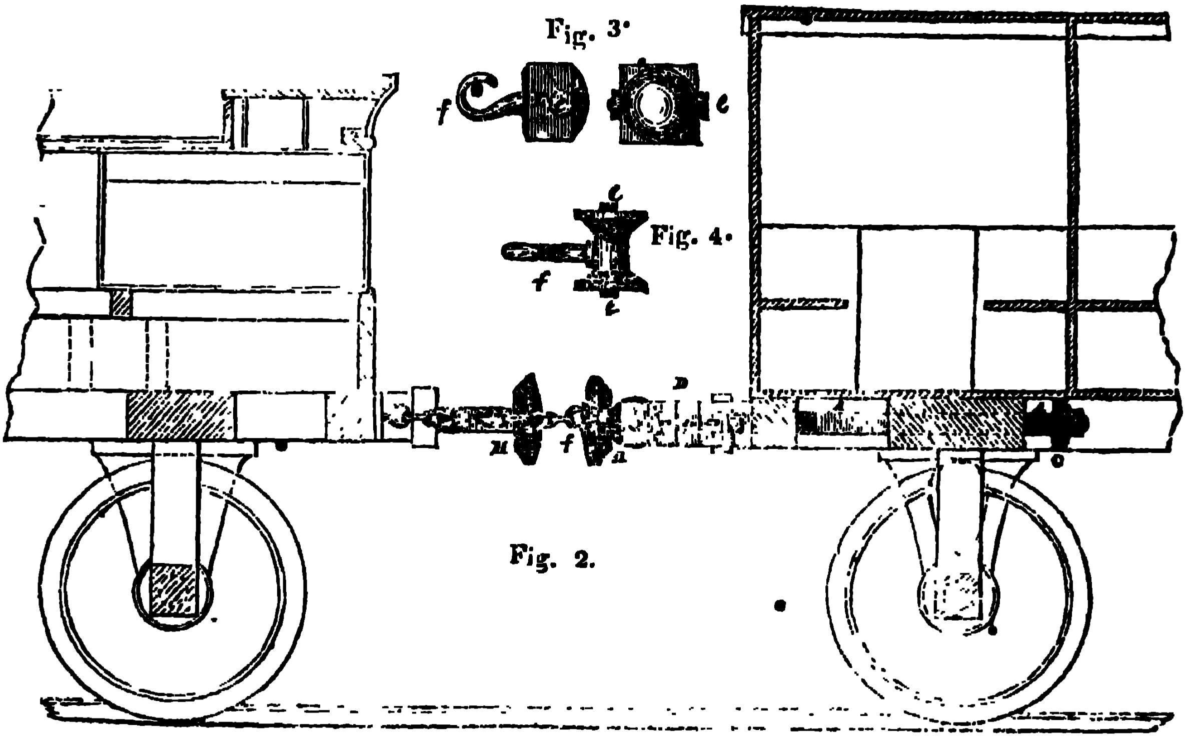


Fig. 3.

Fig. 4.

Fig. 2.

## KENDALL'S IMPROVEMENTS IN CONNECTING AND DISCONNECTING LOCOMOTIVE ENGINES AND RAILWAY CARRIAGES.

Among the new patents specified this week,* there is one by Peter Kendall, Esq., of Gifford's Hall, Essex, for an improved method of connecting and disconnecting locomotive engines and railway carriages, which has for its object, to diminish the dangers arising from engines running off the lines of rails, especially on embankments; and also to facilitate the operation of disconnecting carriages from a train, at stations, &c. The means by which the patentee proposes to accomplish both these desiderata are of a simple and easily testable character; and at a time, when fatal railway accidents are again becoming of lamentable frequency, the railway companies will be wanting in their duty to the public, if they do not give them an early trial.

Fig. 1, (on our front page,) represents a plan of part of a railway carriage "with the additions proposed to be made thereto, for the purpose of more readily connecting and disconnecting the same from a locomotive engine or other carriage to which it may be attached; and fig. 2, is a sectional view of the same through the line *a b*, and also of part of a tender attached in front of it; A is a rod, or pole, which passes under the carriage through the centre of the cross pieces B¹ B² B³ of the frame work, moving freely in the orifices provided for the purpose. The inner extremity of this pole is secured to, and presses against the centre of a bow-spring C, which is attached by its two ends to the back of the cross piece B³, immediately behind the axle of the front pair of wheels. The other, or outer extremity of the pole is armed with two flat, flexible and tapering spring grippers, or arms D D. The bow-spring C and the spring grippers D D, may each be made, either of different steel plates connected together like ordinary coach springs, as shown in the engravings, or in one solid piece of metal of sufficient strength and flexibility. E is a coupling boss (of the form shown in the separate plan and side view, fig. 3,) from the square sides of which project two short pins or axles, taking into two holes in the outer ends of the spring grippers D D, and by which it is held firmly as long as it is pulled in a line directly parallel with the said grippers. The hook *f*, at the end of the boss, serves to connect it by a chain (which may be of any suitable length,) to the rear of the engine, tender, or other carriage in front. G¹ G² are two smaller pairs of spring grippers, one at each side of the centre spring grippers D D, and of like construction, only that they are not attached to moveable poles, but are firmly secured to the front cross piece B¹, (either in the manner represented in G¹, or in that represented in G²,) and which smaller grippers grasp, or carry two auxiliary coupling bosses of the same description, and secured in the same way as the principal boss before described."

Instead of the coupling bosses being of the form represented in fig. 3, they may be of that shown in fig. 4, or of any other equally adapted for the purpose in view.

"The centre spring grippers (D D) must always be of such length only, that when the buffers, H H are driven home, they shall not protrude beyond them; and the smaller grippers must, of course, protrude in a proportionally less degree."

"Each carriage in a train is to be provided with a set of these grippers and coupling bosses. The effect of this method of connection is as follows:—As long as all the carriages in a train remain in the same line of traction, or no farther deviation from a straight line takes place than occurs in the worst cases of curvature or deviation known upon railways, (excepting always termini and stations,) the coupling bosses will remain firmly secured within their respective spring grippers. But, when it is desired to detach any number of carriages from a train, all that is necessary is to pull the coupling bosses by which they are connected with the rest, out of the line of parallelism with the cheeks of their respective spring grippers, (to effect which a very slight force will suffice,) when the separation will be instantly effected.

"Again, should the engine happen to run off the line, the coupling bosses will equally lose their hold in an in-

* Patent sealed April 17; specification enrolled, October 16, 1841.

stant, in consequence of the angular pull thereby given to them, and the danger of its dragging any of the carriages of the train after it will be thus wholly avoided."

"To expedite the introduction of the coupling bosses within their respective spring grippers, there should be attached to the carriage by means of a chain, and close to each pair of grippers, an expander, of a wedge form, as represented in fig. 5, and of corresponding size, by the introduction of which between them, they may be instantly separated to the required extent, and the bosses inserted."

## ANOTHER SUGGESTION FOR SAFELY CONNECTING RAILWAY CARRIAGES.

Sir,—I believe it will be universally acknowledged, that if a method can be found of connecting the trains with the railroad engines in such a manner as that when they swerve from the right line they shall of necessity be at once disengaged, the great desideratum will be attained of securing the safety of the passengers; and as it appears to me that by a very simple contrivance this object may be arrived at, I feel great pleasure in communicating, through your useful publication, which is sure to meet the eyes of all railroad proprietors, a plan that has recently occurred to me, and which, as my sight will not permit me to make a diagram, I shall endeavour to explain by words as clearly as I can—not doubting of your ready insertion of any scheme for the promotion of public safety.

Let us therefore suppose, a strong bar fixed to the engine by a hinge, which allows it only to descend to a level, the other end of which is armed with a key at right angles downwards, that consists of a circular bolt, which drops into a square groove firmly connected with the carriage train, which groove is open at both ends, and has at both ends a slight inclination to the right and left, so that when the engine swerves either way, the round key will slide out by the groove, and the engine at once become detached from the carriages.

I remain, Sir, yours, &c.

GEORGE CUMBERLAND, Sen.

Culver-street, Bristol, Sept. 27, 1841.

## STEAM CARRIAGES ON COMMON ROADS.

Sir,—It is with the most unfeigned regret that I perceive by your last number, Colonel Macerone most pertinaciously reiterates his preposterous statements of his eighteen months' consecutive running with his steam carriage from Paddington, "*without any repairs to the engines or boilers!*"

Having been among the number of those who were politely permitted to accompany the gallant Colonel in one of the trips alluded to at page 292, I willingly bear witness to the excellence of the performance. At the same time, I must state, that at that very time—the first time I saw Colonel Macerone's carriage, although it had been running some months—*the boiler was then actually undergoing some kind of alteration or repair.*

To the uninitiated, Col. Macerone's plausible statement, backed by the official report of the French engineers, may seem to carry conviction; but to those who can boast as much experience in these matters as I can (having been out with all—from Gurney to Hill) such a statement only betrays the weakness of memory, or exhibits the effect of self-deception.

On referring to the description of Mr. Hill's steam-carriage in No. 941, I find the words "cost of traction" quoted by Col. Macerone, was not the expression used. "The actual cost of steam travelling on turnpike roads"—and the "cost of traction," are two widely different things. The cost of traction appears to me to be the cost of the fuel burned on a journey; the cost of steam travelling includes besides this, the wear and tear of machinery, charge at turnpikes, pay of engineer, stoker, &c. &c.

I believe the most successful experimentors in common road locomotion, admit the wear and tear of the machinery to be at least double the cost of fuel; while with many, we know it has most outrageously exceeded that quantity.

I congratulate Col. Macerone on the prospect of reducing his inventions to practical application through the instrumentality of a Company, and hope he will not again prejudice his progress by statements that can never be believed, inasmuch as they so greatly

exceed the limits of probability—nay, of possibility.

I remain, Sir, yours respectfully,
Wm. Baddeley.

London, October 17, 1841.

## ON PADDLE-WHEELS — MR. BURSTALL IN EXPLANATION.

Sir,—Your correspondent "Steam" is so far correct, that in the account of the performance of the *Medea* in Tredgold's Work, the paddles are stated to be 4 feet 6 inches wide, not 3 ft. 4 in. as I had named. I had noticed that in a note, which by mistake I omitted to send you. If "Steam" had read the article with as much care as I have done, he would have seen that it was most probable that the 4 feet 6 inches was a *mistake*. With a deep load, the height of the paddle-shaft is 6 feet 9 inches above the surface of the water; the 4·6 paddle in a wheel 24·6 diameter would be just 1 foot below the water, and when light loaded, as the shaft is then 8·9 above the water, the top of the paddle would be actually 1 foot above the water, and at a medium load, just level. Conceiving this would not be right, I examined the plate of the *Medea*, when I found the paddle drawn 3 feet 4 inches, which I concluded was the correct dimension, as that places the paddle, when the vessel is light loaded, 2 inches below the surface of the water. Again, as the principal merit of Morgan's wheel is working well when deeply immersed, I conceived the constructor would never have placed them so high, that half of their time they would not have dipped enough.

I am not aware that theory is so very flexible as "Steam" seems to think: that any one would falsify data to answer any mechanical notion, is so perfectly ridiculous that I, for one, can conceive nothing more contemptible. The great advantage and charm of mechanical pursuits is, that all its *principles* are founded upon unerring and immutable truths: theory on wrong data may amuse perpetual motion seekers, but will never be entertained by any one who has the least value for true science. My observations on the paddle-wheel have nothing of theory about them. I took the best and most authentic data I could procure, and the best paddle-wheel (at least as to its action in the water); and if "Steam" can show that I have wrongly calculated the *effect*, I shall be obliged to him. As for calling on me to account for the lost power, I do not think I am at all obliged to do that. If I have shown all that is employed in propelling the boat (the only useful part of the power,) I have done all I engaged to do; but if "Steam" will tell me what becomes of the lost steam (*alias* power) when the locomotive steam-engine wheel slips, and the cylinder makes 2, 3, or 4 strokes, while the train progresses at the rate of but one revolution, I will show what becomes of the lost power of the marine engine with the paddle-wheel.

Possibly "Steam" will explain to me, why, if two individuals of equal strength were walking on two parallel roads, the one paved with level and smooth stone, the other covered with a level but deep soft sand, the one on the former will get on fastest and easiest?

One of the greatest difficulties in mechanic inquiries is, the procuring of correct data. If we had in other cases the same data as Messrs. Lean's reports have been the means of procuring for the Cornish mines, we should be at no loss to find the best methods of applying power. In the case of the paddle-wheel we are surrounded with difficulties, all either leading to error or disguising facts. Among the most important are the shape, draft of water, &c. of the hull (which, by-the-bye, I think have been too little considered by the disputants in your pages respecting Clyde and Thames steamers,) winds and tides in rivers; and winds and waves at sea. If the power is tested by trying what the paddle-wheel would lift, supposing a rope were fastened to the stern of the boat over a pulley on shore with a dead weight, that would not tell what was expended to propel the boat when *under way*, unless the engines were driven at such a speed only as would pass the paddle-wheel through the water, at a velocity per second equal to the difference of the wheel and boat at best speed, which is generally only at ¼th to ⅕th of the full speed of the engine.

It is often remarked that more correct knowledge is procured from failures, than successful experiments; so an extreme case will tell better than a moderate one. With this view I will state a case which I have the strongest reason to believe authentic. A 25-horse tug-boat was towing a sloop from the Firth of Forth to Grangemouth, on the Carron, a small river leading to the well-known Carron iron works. It so happened that a strong wind was blowing down the river, and a heavy water or speat was running out likewise; this soon brought the vessels to a stand still, next to going back; the anchor was let go, and a messenger sent to Grangemouth for horses to help. Nine were sent, but only eight were put to the tow-rope; the steam was put on, and with this help, the wind and current were not only stemmed, but in a few minutes the horses got into a trot. If they, then, went

at five miles per hour, according to Leslie and others, the eight horses' power would be reduced to about three actually expended on the rope; thus showing most strikingly the advantages of a solid fulcrum (the ground) for the horses' feet over the sliding fulcrum, the water, for the steam-engine.

If we sit down convinced that nothing can be better than the paddle-wheel, we shall not be likely to introduce any improvements; therefore it is not an idle task to inquire as to its efficacy.

What is undoubtedly wanted, is some method of applying the power which does not depend upon the water of floatation for its action, but is the same, whether the vessel is deep or lightly loaded, whether the water is rough or smooth, and which method shall offer no obstruction to the vessel's progress, either by the wind above the surface of the water, or from the water under the surface. That such an agent may be got is within the bounds of possibility; for canals a rope would be every thing that is desired, but for its cumbrousness when long, and the difficulty of changing from one to the other if in short lengths, as well as in passing curves. I will assure "Steam" that in my short article on paddle-wheels, I believe I have been very lenient on the paddle. If he will note the performance of any of the swift boats on the Thames, he will find that the velocity of the paddle through the water is nearer 6 feet per second than 7·55, thereby reducing the power per square foot, to about 36lbs. instead of 55lbs. The paddle-boards are likewise very narrow, as in the *Watermen*, not the slowest boat, 9 inches, and the dip very small. He may thus with me, begin to suspect that the great velocity of the *swift* Thames boats is more due to the shape of the hull, and the light draft of water, and great proportional power of the steam-engine, than to the efficacy of the paddle as a propelling agent.

I am Sir, &c.

T. Burstall.

## REVOLVING LOGARITHMIC SCALE.

Sir,—The following account of a revolving logarithmic scale may be interesting to some of your readers.

Some time ago I saw in Montferrer's Mathematical Dictionary, in the article Arithomètre, a statement that these arithometers were made and sold at the shop of the publisher of that work, at Paris. It was also stated that the *divisions* might *compete* with those of the best astronomical instruments. On causing inquiry to be made at this publisher's, one of them was found, which it was stated was the last which they had, and the last which would be made, as the expense of dividing, was one on which they found a sufficient profit could not be made. This instrument is now in my possession. It consists of a circular brass plate, on which another brass plate turns, the two being concentric, and having a clamping screw on their common axis. The upper plate is bevelled towards the lower, than which it is somewhat smaller, so that the extremity of the bevelled edge of the upper plate is about $\frac{5}{10}$ths of an inch from the edge of the lower. The diameter of the upper plate (which is, of course, the effective diameter of the logarithmic scale) is $4\frac{1}{4}$ inches. Both edges are silvered, and a logarithmic scale laid down on each, in a manner which needs no description.

I was for some time at a loss, how to estimate whether the divisions deserved the character given to them in the work above mentioned. The mere working of questions, in which the eye must divide the smallest divisions of scale into parts, is not a very satisfactory process; it may settle whether a logarithmic scale is good enough for one or another purpose, but can hardly enable any one to decide whether the divisions are as good as they can be. At last I took the following method, which, being tried on the brass arithometer, and on a wooden sliding rule, turned out so good a test, that I should recommend it to every one who wishes to compare the goodness of different instruments of the kind.

In Goodwyn's "Tabular Series of Decimal Quotients," 1823, there are given all fractions which, being in their lowest terms, have a numerator of two figures, and a denominator of three; these fractions are arranged in order of magnitude, with equivalent decimal fractions (to eight places) annexed. The successive fractions, therefore, differ very little indeed from each other, as in the following specimen, the numerators being in the first column, and the denominators in the second.

| N. | D. | N. | D. | N. | D. | N. | D. |
|---|---|---|---|---|---|---|---|
| 49 | 830 | 57 | 965 | 25 | 423 | 34 | 575 |
| 16 | 271 | 14 | 237 | 37 | 626 | 45 | 761 |
| 47 | 796 | 55 | 931 | 49 | 829 | 56 | 947 |
| 31 | 525 | 41 | 694 | 12 | 203 | 11 | 186 |
| 46 | 779 | 27 | 457 | 59 | 998 | 54 | 913 |
| 15 | 254 | 40 | 677 | 47 | 795 | | 727 |
| 59 | 999 | 53 | 897 | 35 | 592 | | 541 |
| 44 | 745 | 13 | 220 | 58 | 981 | | 896 |
| 29 | 491 | 51 | 863 | 23 | 389 | | 355 |
| 43 | 728 | 38 | 643 | 57 | 964 | | 879 |

More are here given than is necessary, in order to enable any one who sees this to dispense with the book, which is not very common. Begin, by setting 49 on the slide (whether straight or circular) opposite to 83 on the fixed scale; then 16 will be opposite to 271, 47 to 796, &c. But at last (and the better the scale, the sooner) the numerators on the slide will come a little in advance of the denominators on the scale. And if the divisions be perfectly good, this advance will be seen long before it could be measured, and will be uniform and increasing, but if the divisions be bad, or laid down on wood which has altered its shape, the advance, though perceptible, will have jolts; if one numerator be estimated as more in advance of its denominator than the next, it is a sign that there is a visible imperfection in the divisions.

In taking the brass arithometer, and setting 49 to 83, I found 16 inseparable from 271, 47 was suspected to be beyond 796, the suspicion was a little strengthened by looking at 31 and 525, and became a positive certainty at 46 and 779. Now :—

$$\begin{array}{lll} 49 & 830 & = \cdot 059036 \\ 46 & 779 & = \cdot 059050 \\ \hline & & \cdot 000014 \end{array}$$

Hence out of 5905 parts, a part and a half is slightly perceptible. I should have said, on reading the instrument, that 46 was opposite to 779·5, which however is too much. The result seems to be, that near the middle of the scale, an error of 2 or 3 in the fourth place of figures would begin to be perceptible if the divisions could be accurately subdivided by the eye. On a wooden rule of 24 inches radius, I read, as I thought, 779·2, which is nearer. And I have found that this brass arithometer, with a scale of about 13½ inches, what with the superiority of the metal over wood, and the goodness of the divisions, is almost as good, with great care, as the wooden rule of 24 inches. But after all, I do not think the former offers any great temptation: for one, I would rather use a four figure table of logarithms, (which is more exact than any sliding rule now made,)* than take the trouble of using this brass instrument, so as to bring out all its power. And I believe that as soon as the sliding rule ceases to be an instrument for rapid inspection, the small table of logarithms would take less time.

I remain, Sir,

Your obedient servant,

London, October 4, 1841.

## WILLIAMS ON COMBUSTION OF COAL.

*The Combustion of Coal, and the Prevention of Smoke Chemically and Practically Considered. By C. W. Williams.* Second Edition, 8vo., with Coloured Diagrams. London, Simpkin & Co., 1841; pp. 184.

Our readers generally will have become familiar with Mr. Williams's name, in consequence of several communications directly from him, which have appeared in our Journal, as well as from the account in our last Number, of his Patent Improved Furnaces. But it must not be supposed that the treatise now before us is merely a more detailed account of these furnaces; those who take it up under such an impression will be most agreeably disappointed. It is clearly a production of great research, and displays a profound acquaintance with all the beautiful and interesting phenomena of combustion, from the

* The table of "four figure logarithms" alluded to by our intelligent correspondent, is, we presume, that which was printed some years ago for private circulation among practical astronomers, to be used in the reduction of the observed places of stars to the mean; which was afterwards introduced into the able treatise on algebra in the Library of Useful Knowledge; and which has been more recently republished on a card by Messrs. Taylor and Walton. Persons unacquainted with the great value of this table, not only to mathematical computers, but to practical men of all classes, and who are desirous of learning the use of it, may consult with advantage an excellent paper on the Use of Small Tables of Logarithms, &c., by Professor A. de Morgan, which appeared in last year's Companion to the Almanac. —ED. *M. M.*

flame of a common candle to that of the most powerful reverberatory furnace.

No machinist or manufacturer can rise from the perusal of it, without being vastly better informed on the subject of the combustion of coals, the requisites in the construction of furnaces, and the surest means of gaining the object each may have in view. The grand purpose which the author keeps constantly in mind is to inculcate the wisdom of working with nature, and not against her —with her, by attending to the chemistry of combustion, instead of against her, by forcing mere mechanical methods to produce effects which can only be attained through the aid of chemistry, and by a perfect harmony between science and practice.

Mr. Williams carefully examines the constituents of coal. He then proceeds to inquire what becomes of this body when heat is first applied, and finds that every *fresh* charge thrown on a hot fire becomes an *absorbent* of heat before it can increase the general temperature. Expansion and volatalization of the bitumen of the coal follow, generating coal gas; and Mr. W. most satisfactorily proves "that every fresh charge becomes, *pro tanto*, an absolute refrigerator in the furnace, both mechanically and chemically," until the combustion is effected.

The observations of the author respecting coal gas in combustion are highly interesting. Every ton of good coal is estimated to produce 10,000 cubic feet of gas, (p. 36,) capable, when properly consumed, of affording flame and heat, but, "having no power to retain it under the (ordinary) arrangements of a *furnace*, much of it is unavoidably lost."

The limits of this notice will not permit our going into the peculiarities which distinguish the combustion of the fuel on the bars; that is the combination of the *solid carbonaceous* portion from that of the *gaseous* product, the carburetted hydrogen, or coal gas. "The subject of gaseous combinations," says Mr. W., "is, without exception, the most important in the inquiry before us; and those who would study the economy of fuel, and the obtaining from it the greatest quantity of heat, cannot dispense with this branch of it; it is the Alpha and Omega of the process of combustion." Nevertheless, all who are in the least acquainted with boiler-making, and the building of furnaces, must be aware that the most conflicting and contradictory opinions prevail among practical men, and are perpetuated in mechanical works of even acknowledged authority. Why should so much confusion prevail? Because, apparently, combustion has been considered by practical men as under the control of mechanical, rather than of chemical agencies. Furnaces and boilers of almost every conceivable form have been erected; plans of various kinds have been patented to insure impossibilities: one engineer proposes one set of dimensions, which another again alters to what he pronounces to be mathematical precision; so that in the midst of all this disagreement it seems to have been pretty generally decided that success is best attained by having enough of boiler room, enough of fire space, and enough of atmospheric air, that we may thus *gain* on the one hand by a *loss* on the other. Tredgold, though his practical rules were not grounded on true chemical laws, speaking of "the construction of fire-places for boilers," makes an admirable observation:—"Now, without some knowledge of the nature of the operation of burning, it will scarcely be possible to do any thing good, *except by mere accident*. We should be like seamen in a vessel at sea without a compass, with as little chance of steering to the intended port." Mr. Williams, in availing himself of the best chemical information on the subject, has indicated where that "compass" is to be found, by which alone practical men can hope to steer aright, in this department of their business.

Strongly recommending Mr. Williams's treatise to all who are interested in the subject, (and who is not?) we will conclude in the author's own words. "And let no mechanic feel alarmed at this introduction to 'elementary atoms,' and 'chemical equivalents,' or imagine it will demand a deeper knowledge of chemistry than is compatible with his sources of information; neither let him suppose he can *dispense* with the knowledge of this branch of the subject, if he has any thing to do with the combustion of coal."

### MR. CURTIS'S CEPHALOSCOPE.*

(Registered pursuant to Act of Parliament.)

When we consider how universal is now the use of the Stethoscope, invented about thirty years ago by Lænnec, and the immense service it has rendered in detecting by the ear diseased affections of the chest and abdomen, it is surprising that so long a period should have elapsed without its ever occurring to any one that the instrument might be adapted to discover, with equal ease and certainty, the causes of many of those aches of which the head is the peculiar seat—all those at least, which are of a local, and not merely sympathetic character. For its adaptation to this purpose we are at length indebted to Mr. Harrison Curtis, the eminent aurist, who has given to the instrument, in this its new form, the very appropriate name of *Cephaloscope*. From the annexed engravings of the different parts of the instrument, it will be seen that it differs from the stethoscope chiefly in the greater size of the bowl, which is made of capacity enough to enclose the external ear completely. Fig. 1 represents the instrument in its complete state; fig. 2 is a plan of the bowl; and fig. 3, a plan of the ear-piece. It is all of wood, except the bowl and ear-piece, which are made of ivory, (for the sake, we presume, of ornament.) When used, the mouth and nostrils are closed, and from the sounds then conveyed by the instrument to the ear of the examiner he is said to be able, after a little practice, to discriminate with great exactness between healthy and diseased states of the Eustachian tube, tympanum, &c.'

Fig. 1.

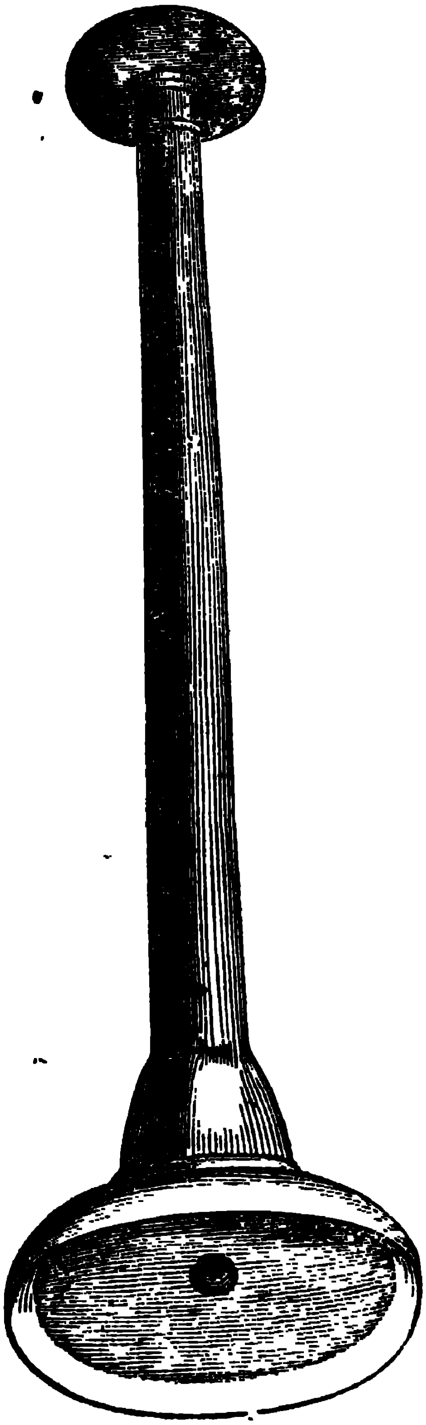
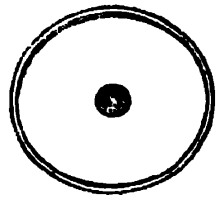


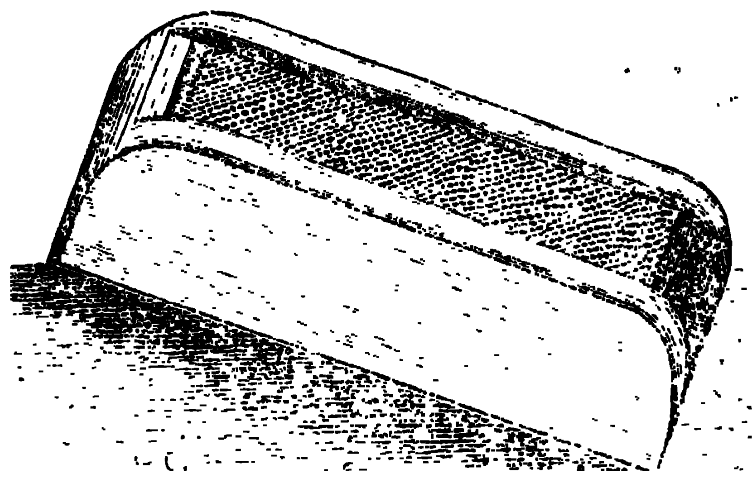
Fig. 2.

Fig. 3.



## HANCOCK'S STEEL PEN RENOVATOR.

(Registered pursuant to Act of Parliament.)



The little article represented in the prefixed sketch (which is of the full size) is calculated to afford more real comfort to a larger portion of the writing community than any thing else we are acquainted with: calculated, as it is, to remove at least nine-tenths of the inconveniences and annoyances attending the use of steel pens. These pens are highly prized for not requiring mending, and yet how often do we wish that they could be rendered objects of amendment! Having provided ourselves with Stephens's inestimable fluid, we have surmounted all the obstacles presented to the use of steel pens by common writing ink, but still many annoyances remain "to vex and fret us." When a pen becomes corroded and encrusted, we discard it for a new one, the greasiness and unwillingness of which to take the ink, for some time retards our penward progress; but this difficulty is no sooner got over, than the point of our pen becomes clogged with an accumulation of fibres from the surface of a cottony paper which our stationer has sent in to us as veritable "Whatman's." In vain we ply our "pen-wiper," for it affords only an exchange of evils, substituting woolly fibres for those of cotton, and we are almost disposed to abandon "cold steel" for ever, and resume our "gray goose quill"—but that our penknife has grown rusty, and our eyesight rather dim. In this dilemma therefore—and we are not alone, although the sympathies of suffering thousands bring us no relief—we hail with no common joy the appearance of "Hancock's Steel Pen Renovator."

This simple and ingenious little instrument contains a remedy for all the ills of all our pens.

It consists of a piece of fine wire card mounted in a neat mahogany frame, at the extremity of which is placed a piece of velvet.

No matter whether a steel pen is corroded, encrusted, clogged up, or greasy; two or three wipes over the card, toward the velvet end of the instrument,—and all is right.

The inventor has protected his invention under the Registration Act; the article is, however, supplied at a very low price, and no user of steel pens should be without one.

## THE DUTY OF CORNISH ENGINES.

Sir,—It is still a disputed point, whether these engines perform any thing like the duty above the rotative, stated by Mr. Pilbrow in his pamphlet. Pray where does that gentleman get his facts from? I am aware that Mr. Fairbairn stated at the Manchester Geological Meeting last year, that "we consume four times more coal than the Cornish engines in producing the

same effect:" that he also stated, "he had himself made a calculation of the *effective* force of the factory engines in Manchester, and found that in the best condensing engines, the consumption was from 10lbs. to 12lbs. per horse-power per hour, while the best Cornish engines consumed only 2½lbs." Mr. Fairbairn, then, confirmed his statement from a return of Mr. Wicksteed's, of the East London Water-works, where the consumption was only 2·4lbs per horse-power; observing there could be no mistake here, "as it was not a pit at all." I admit that the best Cornish engines perform their work with only 2½lbs, or 3lbs of coals per horse-power, for this fact has been so frequently proved by disinterested and competent persons of all kinds, as to remain no longer doubtful. It is admitted in the class of facts of science for reasoning on. But I much question if the best rotative engines consume more than 4lbs or 5lbs on their actual power.* Where are the diagrams of rotative engines from which their actual power was calculated for the comparison? I would ask Mr. Fairbairn whether he did not calculate upon the maker's nominal horse-power? We know if the indicator is applied to good London-made engines which are sold under the nominal term of 100-horses power, it will show an actual effective power (after deducting for friction) of 150-horses. To say, as Mr. Fairbairn does, that rotative engines consume 10lbs to 12lbs upon their actual power, is little better than an absurdity, for this would make them consumers, on the makers' nominal power, 15lbs to 18lbs per horse power per hour! If by "*effective* force of the best condensing engines," he did not mean the actual power, then his calculation is erroneous, and he should not have given it. It is probably in comparing the actual effective power exerted in Cornwall, with the nominal (instead of with the actual net effective) horse-power of the rotative engines, that so much error has resulted.

If so, the better kind of boiler, slower and more complete combustion, superior clothing, the cushion of steam, and the use of steam expansively at a much higher pressure, will perhaps make up the difference of the greater duty of Cornish engines. I do not lose sight of their superior cylinder exhaustion, upon which, in relation to Mr. Pilbrow's condensing cylinder engine, I may trouble you with a few observations; but let us first clear the way, by establishing undoubted facts, and I should like to hear his opinion on this communication previously.

I am, Sir,
Your obedient servant,
SCALPEL.

August 9, 1841.

* The correctness of this conjecture has been fully confirmed by the statements given in our concluding notice of Mr. Russell's work on Steam Navigation, and which have been derived from the most authentic sources. ED. M. M.

## THE "BLACKWALL" STEAMER.

Sir,—In page 281 of your Magazine, two questions are put to me by a correspondent calling himself "Dicque," which I trust you will deem sufficient apology for my further troubling you. In the first place, he asks, "what matters the high pressure at which the engine of the *Blackwall* is worked, supposing the boilers and machinery strong enough to resist the pressure?" Now, I am not aware that I ever complained of the high pressure of the steam, for I could never find out what it is, but of the *mystery* observed by the engineers and others employed in her with regard to that pressure. Nor do I think there is more danger with high pressure than with low, if used with due caution and proper management; it requires an engineer of more science than low pressure steam.

Secondly, he asks whether I do not think the shock is caused by the "size and fall of the connecting machinery from the piston-rod to the crank?" My answer is, certainly not, for this reason, that the shock is as great in the down as the up stroke, which would not be the case were it caused by the weight of the connecting machinery, &c.

I am, Sir,
Your most obedient servant,
A MECHANIC.

October 8, 1841.

ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

*** *Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for that purpose.*

GEORGE EVANS, OF DORSET-PLACE, MARY-LE-BONE, SURGEON, *for an improvement or improvements upon trusses for the relief of hernia.* Enrolment Office, September 29, 1841.

The first improvement consists in the employment of an elastic vegetable substance, called "moc-main," the product of the silk cotton tree, (*Bombax heptaphyllum,*) for stuffing the pads of trusses.

The second improvement consists in the combination of such pads with metallic springs and levers, in the formation of trusses for the relief of *inguinal hernia.*

A metal plate, covered with leather or other suitable material, forms the back of the pad, to which one end of a brass spring lever, or a hinged metal lever and spring, is secured by three screws or rivets, placed triangularly; the projecting heads of these rivets form buttons to which an encircling bandage is fastened, which gives the proper obliquity to the pad. The other end of the lever has a single button, for holding the secondary bandage, which regulates the pressure of the pad on the hernial opening. The pad is faced with some elastic material, that will allow free play to the natural elasticity of the moc-main, without producing creases on the surface of the pad when it is compressed.

The third improvement consists in the combination of the moc-main pad with two spring levers, in the formation of trusses for the relief of *umbilical, or femoral hernia.*

A double spring lever is screwed to the middle of the pad-plate, having a button at each end, to which the bandages are fastened, the ends of the lever forming springs. Or, instead of this, a pair of levers hinged together may be fastened to the middle of the pad-plate, each lever being furnished with a spring acting upon the pad-plate. Or a pair of levers may be hinged to the ends of the pad-plate, one lever passing through the other, and each carrying a spring which presses on the pad-plate.

The fourth improvement is a combination of a moc-main pad, covered with caoutchouc, with springs and levers, in the construction of trusses for the relief of *prolapsus ani.*

A spring lever, or hinged lever and spring, is attached to the pad-plate, in a manner similar to that mentioned under the second improvement, but with this difference, that the lever in this case has only one button at each end, on which two straps are buttoned, that descend from a body belt, and pass down before and behind the body to the button.

The fifth improvement consists in the use of a pair of lever springs, with a spiral spring acting in a tube, in the construction of trusses for the relief of *prolapsus uteri.*

A depression or cup is formed in the upper surface of this truss, for the neck of the uterus to rest upon, and there are two perforations in the side of the cup for the drainage of any moisture down the outside of a stem. The upper part of this stem consists of a tube screwed into the head, containing a spiral spring, against which the end of a lower stem presses; the lower stem slides in the tube, and is guided and retained in it by a screw stud working in a groove. To a cross head on the bottom of the lower stem a pair of lever springs are affixed, to the ends of which the bandages are fastened. This truss is coated with caoutchouc, to defend it from moisture.

The claim is, 1. To the use of moc-main, or silk cotton, as a stuffing for the pads of trusses generally. 2. To the combination of a moc-main pad with a lever spring, or with a hinged lever and spring, and with three studs or buttons in a triangular position on the lever, in the formation of a truss for the relief of inguinal hernia. 3. To the combination of a moc-main pad with two spring levers, or two hinged levers and springs, in the formation of a truss for the relief of umbilical, or femoral hernia. 4. To the combination of a moc-main pad covered with caoutchouc, with a hinged lever and spring, or with a spring lever, in the construction of a truss for the relief of prolapsus ani. 5. To the combination of a pair of lever springs with a spiral spring, acting in a tube against a sliding stem, in the construction of a truss for the relief of prolapsus uteri.

ALEXANDER PARKES, OF BIRMINGHAM, ARTIST, *for certain improvements in the production of works of art in metal, by electric deposition.* Enrolment Office, September 29, 1841.

These improvements consist in manufacturing articles in gold or silver by means of electric deposition upon suitable moulds, and in subsequently strengthening the articles so produced.

For this purpose the patentee uses the following solutions of these metals:—

Gold. An ounce of pure gold is dissolved in aqua regia, and evaporated to dryness, when 2 gallons of water and 16 ounces of prussiate of potash are added to it. This solution is used at a temperature of 120° or 130° of Fahr.

Silver. An ounce of pure silver dissolved

in nitric acid is precipitated as oxide of silver, by lime-water; the oxide being well washed, is mixed with 1 pound of prussiate of potash in 2 gallons of water.

The moulds used for this purpose are of metal, or other suitable material, in one or more parts, and may be removed from the finished article by melting or dissolving them.

The patentee prefers to use the compound or independent battery, from which the electric current is conveyed from the battery into a cell or vessel containing the metallic solution, and a plate of gold or silver to be eroded by the electric action.

If the metal is to be precipitated on the interior of a mould, as in forming a bust, &c., the plate is placed within the mould; but if the metal is to be deposited on the external surface of the mould, the plate is placed on the outside thereof.

If the article produced requires greater strength than would be desirable to be given by the thickness of the precious metals, it may be strengthened by depositing copper within it, until the required substance is obtained; or the article may be filled with some fusible metal.

The claim is, 1. To the mode of manufacturing articles in gold and silver, by depositions thereof, by electric agency, in or on suitable moulds or models, which may be removed from the articles of gold or silver when the same have been formed. 2. To the mode of manufacturing articles of gold or silver, on or in metal moulds or models, which are deposited by electric means; such moulds or models being afterwards removed as described. 3. To the mode of manufacturing articles of gold or silver by electric deposition on or in moulds or models, when such moulds or models are removed by heat or solution. 4. To the mode of manufacturing articles of gold or silver by electric deposition in or on moulds or models made up of parts. 5. To the mode of strengthening articles of gold and silver produced in or on moulds by electric depositions, by introducing a baser metal within them.

JAMES TILDESLEY, OF WELTON-HALL, STAFFORDSHIRE, FACTOR, AND JOSEPH SANDERS, OF WOLVERHAMPTON, LOCK MANUFACTURER, *for improvements in locks.* Enrolment Office, September 29, 1841.

The first improvement consists in a mode of constructing the sliding bolt of locks. The bolt in this case consists of a sliding plate, with four tumblers and their springs, which moves upon a pin, or stud, and carries in its front end an axis, upon which the tumblers are mounted. The other ends of the tumblers are provided with slots, or openings, through which the pin protrudes, and passes when the bolt is moved by its proper key. But should a false key be introduced, the openings in the tumblers will not coincide with the path of the pin, and the bolt will therefore remain immovable. A detector is also shown as applied to this arrangement, by which the introduction of a false key is indicated.

The second improvement consists in the application of sliding tumblers to the sliding bolts of locks. A bolt of the ordinary construction, has a portion of its upper part, near its middle, removed, to make room for a projection affixed to the lock case. This projection passes through a vertical slit formed in each of three vertical tumblers; there is a fourth, or bolt tumbler, connected to the bolt and moving with it. In each of the extra tumblers there is a horizontal slot, through which a pin on the lock tumbler enters, and allows the bolt to be slid back by the key, when it has brought all the tumblers into their proper positions. The extra tumblers have a vertical movement only, but the lock tumbler slides up and down a pin affixed to the bolt, and also follows the horizontal movement of the bolt, being contained in a recess in its side.

The third improvement consists in a peculiarly formed sliding and lever catch bolt, suitable for drawer or other locks. This bolt is composed of a sliding plate, and three tumblers, which move on an axis affixed to the lower end of the plate. The tumblers have each two notches near the top, (one in each edge,) and are provided with a spring, which gives the requisite movement to the tumbler while the bolt is being shot. When the bolt is shot, the notches in the tumblers are level with the face plate of the lock, on which they catch, and the bolt cannot be withdrawn by any key unless it will cause the tumblers to range correctly together; for should any one of the tumblers be moved too far, its opposite notch will catch on the plate and hold the bolt fast.

JOHN LINDSAY, OF LEWISHAM, KENT, ESQUIRE, *for improvements in covers for water closets, night-stools, and bed-pans.* Enrolment Office, September 29, 1841.

These improved contrivances are closed by a wooden cover or extinguisher, round which is fastened a strip of woollen cloth or other elastic material. Outside of this there is a band of chamois leather, having a hook at one end to secure it by, and a hole is made in the cover, which is closed by a peg. The extinguisher being pressed down in the pan with the hole open, the air escapes through it, and when low enough, the peg is inserted in the hole, and closing it air-tight, prevents the farther escape of any foul air or smell into the apartment.

THOMAS GORE OF MANCHESTER, MACHINE-MAKER, *for certain improvements in machinery or apparatus for roving, spinning, and doubling cotton, silk, wool, and other fibrous materials.* Petty Bag Office, September 30, 1841.

In this apparatus the spindle is secured to the spindle-bar of the frame at its lower end by a set-screw; upon its upper end there is a tube, having at top a sheave or pulley, and directly under this pulley is a flyer. A bobbin, the upper part of which encloses the lower end of the tube, is placed upon the spindle, and beneath the bobbin is the copping rail, which gives it the necessary up and down motion.

The thread is delivered from the front drawing roller as usual, and passing through an opening in the pulley and tube to the eye of the flyer, proceeds on to the bobbin. The pulley, flyer, and tube being finally connected together, a band passes round the pulley and communicates the required motion to them.

JOSEPH GAURY, OF WATLING-STREET, WAREHOUSEMAN, *for a parachute to preserve all sorts of carriages from falling, or from injury, upon the breaking of their axletrees.* Enrolment Office, September 30, 1841.

The apparatus to which the singular, and, as it appears to us, the inapplicable term of "parachute" has been given by the inventor, constitutes a supplementary axle-tree, and is applied to two-wheeled carriages in the following manner:—A metal box is attached by bolts to the nave of each wheel, having a groove on its periphery, in which a collar is secured by a cap; to these collars a pair of separating bars are screwed, which, in the event of the axle breaking, keeps the wheels in their proper position, and sustains the vehicle.

In another arrangement, the box has a groove in its interior, in which a plate or washer works, to which one end of a forked bar is fastened, the other forked end being attached to a similar washer on the opposite wheel. The forked ends of the bars are provided with legs, by which they are fastened to the axle-tree by screws and nuts.

Other modes of applying this invention are described, all having for their object to preserve the carriage from injury, and to continue its running in the event of the ordinary axle-tree breaking.

WILLIAM JENKINSON, OF SALFORD, MACHINE-MAKER, *for certain improvements in machinery, or apparatus for preparing and spinning flax, and other fibrous substances.* Petty Bag Office, September 30, 1841.

These improvements consist in the application to machines upon the mule principle—*i. e.* to machines now in use for spinning the finest numbers, or qualities of yarn made from cotton—of the draft or drawing rollers, with the ordinary gearing hitherto only used in the throttle frame.

These drawing rollers (the arrangement, numbers, or diameters of which, are varied according to circumstances) are applied to the ordinary roller beam of the mule: and the carriage, with the spindles, is caused to recede from the drawing rollers as they deliver the yarn. When a certain length has been delivered, and received the requisite twist, the carriage is forced back again, at the same time the yarn is wound upon the spindles in the form of a cop.

The claim is to the application of the draft rollers to the machinery, or apparatus called the "mule," so as to constitute a new spinning or roving machine for those fibrous substances of long stable or fibre, which have hitherto been spun either by hand, or upon the throttle principle; and also the application of the same to machines to be used as roving frames, by the substitution of "stretching frames" for bobbin and fly frames.

JOHN ORAM, OF CHARD, SOMERSETSHIRE, MECHANIST, *for improved machinery, or apparatus for making or manufacturing netted fabrics.* Petty Bag Office, Sept. 30, 1841.

This improved machinery is for the production of netted fabrics, such as fishing nets, as well as ornamental net work for ladies, dresses; the meshes being connected to each other by a fast tie, or knot of the kind known as the "fishing-net knot."

The machinery is mounted upon a rectangular frame, and contains two series of bolts or combs, one at the front, the other at the back, upon which a series of bobbins and their carriage slide, by means of front and back pushers, and by an extra row of front pushers placed above the first. A front and back catch bar is provided, to draw out the carriages when the action of the pushers has ceased, and the front of the machine is furnished with a row of points for taking up the work. During the formation of the work, the slack threads are taken up by two series of extra points placed at the back of the machine. Four series of hooks stand vertically along the centre of the machine, which act in pairs, being each fixed upon a separate bar. The bars are attached to longitudinal bars, by which they are raised and depressed in pairs, and the respective series are capable of being slidden to and fro, by means of springs and arms; which motions enable the pair of hooks to take hold of the threads at the proper time, to open the loops and to release the threads, when their parts of the operation are completed. The knots are formed by the hooks taking hold of the threads, drawing them down severally into the form of loops, and distending their sides,

when the bobbins pass through them and complete the knot.

The threads being carried up from the bobbins, are fastened on the work beam, which is mounted in a frame, moved up and down by suitable mechanism, so as to tighten the knots.

The claim is to such an arrangement of mechanism as shall be capable of moving a series of bobbins, so as to pass any two threads or yarns round, or between one another, and through loops formed by such threads, to effect a fast tie or knot, of the kind described.

WILLIAM EDWARD NEWTON, OF CHANCERY-LANE, CIVIL ENGINEER, *for certain improvements in the process, mode, or method of making or manufacturing lime, cement, artificial stone, and such other compositions, more particularly applicable for working under water, and in constructing buildings and other works which are exposed to damp.* (A communication.) Petty Bag Office, October 3, 1841.

The nature of these improvements are sufficiently described in the claims, which are as follows:

1. To the application of certain new means, to change or convert all descriptions of lime into hydraulic limes and cements, or such as become hard under water, or when exposed in damp situations, by combining those limes and cements with silica, alumina, and the oxide of manganese or iron, either by the dry or humid methods.

2. To the manufacture of hard artificial stones from chalk, plaster, and all porous stones in general, by injecting into them, or imbuing them with, silica, or the carbonates of magnesia or lime, by any of the processes described; or by causing them, by virtue of their porosity, to absorb either melted sulphur, or bituminous, resinous, or fatty matters, properly liquified by means of heat.*

3. To the employment of the silicates of potash or soda, for making or forming a stony plaster or coating upon a variety of substances, thereby preventing iron from becoming rusty or oxidized, and rendering wood and other organic matters harder, and not liable to decay.

JAMES OGDEN, OF MANCHESTER, COTTON SPINNER, AND JOSEPH GRUNDY WOOLHAM, OF MANCHESTER, COMMISSION AGENT, *for certain improvements in looms for weaving.* Petty Bag Office, October 3, 1841.

These improvements, which are four in number, are as follows.

Firstly, in forming the slay, shuttle-race, and picker, of metal. The main rail, or shuttle-race of the slay is of angle iron, and supports at each end a box, or chamber, composed of top and side rails, to guide the picker, while impelling the shuttle. The picker is tipped with leather where it meets the point of the shuttle, and has an opening formed through it for the passage of the picking levers which give motion to it.

Secondly, in altering the reed to vibrate upon its lower rail, leaving its top rail loose, instead of being fixed in the usual manner in its mounting. By this means, at every stroke of the slay, the cloth pushes the top rail of the reed back against two elbow catches, and lifting their lower ends, prevents their coming in contact with a notched stop piece; but in the event of the weft-thread breaking, or the cloth not being made, the reed is not pushed back, and consequently the catches strike the stop-piece, and throw the loom out of gear.

Thirdly, in removing the cloth-beam, breast-beam, and temples, and substituting three rollers, which are placed in front of the reed. The cloth passes round these rollers, which hold and distend it, and by their continuous rotary motion deliver it in folds into a box or trough beneath, instead of being wound on a roller or beam as usual.

Fourthly, in placing two small rollers under the yarn-beam, against which they are pressed by a strong spiral spring, and as the yarn-beam decreases in diameter, a diminishing pressure of the rollers is produced by the relaxation of the spring. The yarns or threads are thus drawn into a state of tension, and the slack taken up by the revolution of two eccentrics, thereby tightening the shed without the usual backing of the yarn-beam.

JOHN GEORGE BODMER, OF MANCHESTER, ENGINEER, *for certain improvements in the construction of screwing stocks, taps, and dies, and certain other tools, or apparatus, or machinery for cutting and working in metals.*— Petty Bag Office, October 3, 1841.

There are no less than fourteen different improvements included in this comprehensive title, which are briefly as follow.

1. An improved lathe for turning cranks and eccentric work. For this purpose the face-plates are furnished with teeth which are driven by two pinions on the same shaft, and therefore more simultaneously. There are slide-catches, and sliding centres for holding the cranks to be turned.

2. An improved apparatus for connecting and disconnecting lathes, or other machinery from the main gearing, which obviates the inconvenience attending the ordinary apparatus.

3. An improved universal joint for connecting shafts together. On one end of a

* The hardening of plaster and other porous bodies, by the absorption of resinous or fatty matters, is a process that has been in use for years; this part of the patent, therefore, is not tenable.

shaft a bush is formed, and turned out cylindrically at its outer end, and spherically at its inner end, its bottom being flat. A spherical shoulder on the other shaft exactly fits the concavity in the bush, and is held in its place by a lid screwed to the bush. The bush is connected to the latter shaft by two flat grooves cut in the shoulder, (one on each side) and the bottom of each groove follows a circle struck from the same centre as the spherical shoulder of the shaft. Two segments work in these grooves, from the backs of which two pins project, and work in round holes in the bush, whereby the two shafts are connected, and turn together.

4. A tool for constructing the heads of connecting-rods, crank-rods, &c., upon an improved principle.

5. An improved screwing stock, and the use of oscillating dies, in one modification thereof. The box of the screw-stock, (which may be of iron or steel,) has a guide die "recessed" and keyed in one end of it. The vibrating cutting die is so fixed in its holder, as to accommodate itself to the inclination of the thread when it begins to cut on the surface. This die is advanced by the handle of the stock, in the following manner:—The end of the handle being tapped, enters a female screw formed in the holder, just behind the cutting-die, so that on turning it round, its end will press against the die and push it forward. This arrangement may be employed to move the guide die, instead of the cutting die, if preferred. The holder of the cutting-die is "recessed" into the stock, like the guide-die, having enough room in the outer end of the recess to allow that part of the cutting-die which would drag when the stock is turned in the opposite direction, to recede out of the thread, so as to clear away the particles of metal. The moment the handles are pulled by the workman, the die bites on the side which is moved deepest by the pull, and more out of cut on the opposite side. In using oscillating cutting dies, the handles or set screws act upon two dies, which fit the interior of the stock, and against the faces of these dies the two cutting-dies slide laterally; these dies are confined between two plates screwed or rivetted to the stock in the ordinary way. By this means, when the two cutting-dies are tightened up against the bolt to be screwed, they recede in a direction contrary to the pull, as much as the space between the dies and the side of the stock will allow; and in so doing, operate as before described with reference to the vibrating dies.

6. An improved convolute tap, which, after being nearly finished to the right measure in the screwing-lathe, is brought under the operation of mechanism in the tap-cutting lathe, by which the tap is not only eased in a convolute form, as usually done by hand, but the bottom and sides of the thread are also relieved, so that the tap cuts its way through the nut, instead of being merely pressed through.

7. An improved tap-cutting lathe.

8. An apparatus for regulating the threads of screws, so that the whole length of the screw, as well as any given portion of it, agrees exactly with the corresponding multiple of its pitch.

9. An improved slotting machine.

10. An improved double-drilling machine.

11. Improved self-acting face-plates, or chucks.

12. A machine for planing pieces, the form of which would render it difficult to operate upon them by the ordinary planing machines.

13. An improved method of giving motion to the tables of planing machines; and also improved starting and reversing apparatus applied to such machines.

14. An improved mandril press, drifting, and punching machine.

WILLIAM LITTELL TIZARD, OF BIRMINGHAM, BREWER, *for certain improvements in apparatus for brewing.* Enrolment Office, October 5, 1841.

These improvements relate, first, to the mash-tub, which is in this case a cylindrical vessel, having on its upper edge a circular rack, in which an endless screw is made to work by the following contrivance. A bevel wheel fixed on a hollow vertical shaft in the centre of the mash-tub works into a corresponding wheel on a horizontal shaft, at the other end of which is a worm-wheel, carried by a box and working a second worm-wheel at right angles to the horizontal shaft. Motion being given to the worm from a steam-engine or other prime mover, its rotation causes a cross-bar, supported by anti-friction rollers on iron standards, to revolve horizontally round the centre of the mash-tub. To this cross-bar, an "attemperator" is fixed, consisting of a frame supporting two rows of vertical ziz-zag pipes, with machinery for giving them a lateral motion to and from, as well as around the centre of the mash-tub. These two series of pipes are connected by an elastic hose, to allow the parallel bars, which carry each series to approach to, and recede from, each other as they oscillate round their common centre in a contrary direction, and pass and repass each other. All being ready for mashing up, motion is communicated to the "attemperator" as it lies buried in the mash, which reposes on the perforated false bottom of the mash tun. Hot water, or steam, is led through the zig-zag pipes of the "attemperator," its heat and velocity being so regulated as to main-

tain the mash at the required temperature for any length of time, at the will of the brewer. The operation of mashing having been completed, the "attemperator is removed, and the "hystricon" attached to the horizontal cross-bar. The "hystricon" consists of a movable apparatus for sparging the mash with hot water, and continually changing the surface of the grains so as to subject the whole of them to its action: and a belt for discharging the spent grains from the mash-tun. The end of the "hystricon" is attached to a square box in the centre of the mash-tub, as well as to the cross-bar, and revolves with it. The "hystricon" and square box have a downward motion given to them by a screw, placed beneath the bottom of the mash-tub. The front of the "hystricon" travels just below the surface of the grains, which, as it revolves, ascend the inclined iron surface of the conductor, and pass on to an endless web, from whence they are discharged down the hollow shaft, which forms the centre of the mash-tun. Immediately behind the endless web there is a "sparger," or hollow pipe, perforated with small holes, through which jets of hot water issue on to the fresh surface of the mash, and wash out the whole of the saccharine matter. The "sparger" is followed by an "agitator," or "porcupine," for the purpose of disturbing and exposing the surface of the goods to the action of the "sparger." This "agitator" has a rotary reciprocating motion given to it by a ram-wheel, and connecting rod moving it along the toothed surface of a fixed sector.

The second improvement relates to a "hop converter," which consists of two perforated plates, the lower one being situated a little way from the bottom of the under back, and the other a short distance above it. The hops are placed between these two plates, and before the wort is let down into the under back, the hops are saturated with water and are heated by means of a steam pipe, so as to favour the extraction of the virtue of the hops by the wort as it passes through them to the fermenting tun.

The third improvement consists of a "subterraneous fermenting room," sufficiently deep to possess an uniform temperature of from 45° to 52° of Fahr.; which depth in Great Britain, is generally not less than 70, nor more than 90 feet. It is considered desirable that such room should be supplied with water from its own interior surfaces, and partitions of iron-plates or masonry, are employed for the purpose of damming up such waters to nearly the height of the fermenting tuns; any superfluous water, as well as the carbonic acid gas being carried off by drains or removed by pumping.

The worts having remained a proper time on the cooling floor, are admitted into the fermenting vessel by a refrigerating pipe, which passes through the water surrounding the fermenting vessels, and imparts their superfluous heat thereto. The whole of the worts being pitched, they are set to ferment (either with or without yeast) at a temperature corresponding with that of the refrigerating water. The fermenting squares may be either left open, or closed by means of covers, the ledges of which are so deep as to enter the water which surrounds the squares, and form an hydraulic joint; a provision which may be necessary under certain circumstances, in order to prevent too great an absorption of oxygen, or an extravagant evaporation of the alcohol and other volatile properties of the fermented worts. Any waters dripping from the roof of the cavern are led off by a metallic shield to the sides. When the worts have been properly fermented, cleansed, and fined, they are drawn off through racking taps suitably arranged for that purpose. To avoid disturbing the grounds, or lees of the liquor, the tap is furnished with a racking tube, the end of which floats just below the surface, by which means the finest of the beer is racked off without forming any current in its body.

The fourth improvement consists of a peculiarly constructed lamp for lighting, without heating, the fermenting room; it consists of a series of concentric glass cylinders through which a current of water passes, and absorbs the heat while the light is transmitted. The tube which supplies the lamp with air passes down to within a few inches of the floor, and acts as a safety lamp, by indicating the rise of the carbonic acid gas in the cavern.

The fifth improvement is in mills for crushing malt, and consists in the employment of a spring working against a sliding rod, which keeps the carriage of the smaller roller close up against the end of a regulating screw. The rollers are thus kept at a certain distance asunder, but in the event of any hard foreign body getting between them, they give way, and remain uninjured. In another arrangement, a weight, and toggle lever is employed for this purpose in lieu of the spring.



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# Mechanics' Magazine,

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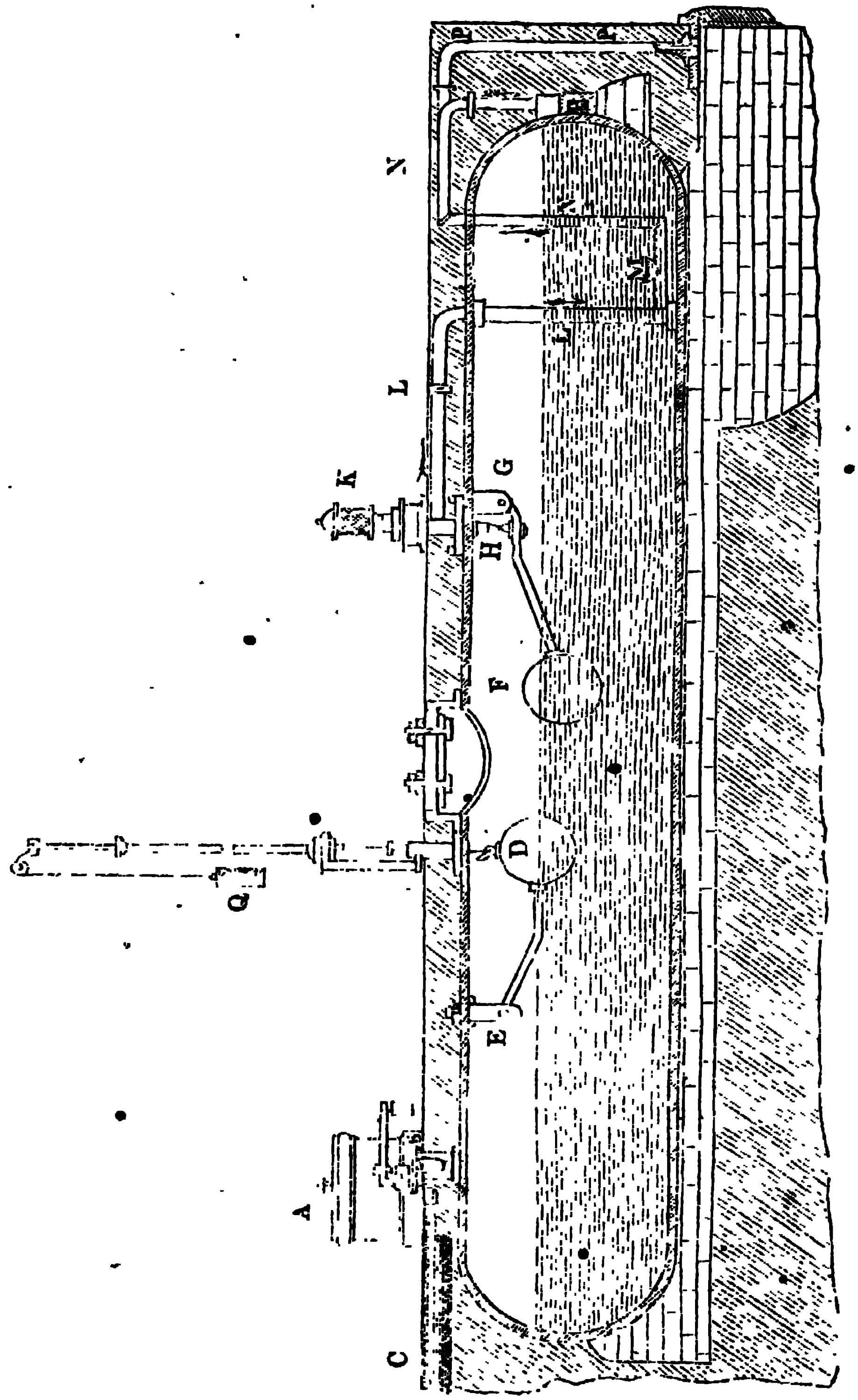



STEAM BOILER ALARUM AND SAFETY GAUGE.

## STEAM BOILER ALARUM AND SAFETY GAUGE.

Sir,—I beg leave to inclose a drawing and description of a new plan for obviating explosions in boilers.

It is well known that these accidents happen, for the most part, from the sinking of the water in the boiler below the right level. Accordingly, I have adapted a signal whistle to the boiler, which would whistle as soon as the water sunk low enough to occasion real danger; and at the same time, by my plan, water would be injected into the grate, and thereby the fire extinguished, or much lessened. I have introduced also a different system of safety valves, and an indicator (which is nothing new) as shown in the description.

Hoping you will consider the plan important enough to insert it in your valuable Magazine for the practical consideration of mechanics and engineers,

I remain, Sir,

Your constant reader,

G. F. B.

London, October 6, 1841.

*Description of the Engravings.*

A is a steam-tight box, containing a common safety-valve, loaded to the maximum pressure of steam, with an outlet through the tube C, where the steam can escape. B is a second safety-valve to be used when desired to work below the maximum pressure. The indicator Q, shows the level of the water in the boiler, and is attached by a string to the hollow copper ball D, turning in bearings at E. F is a second ball, turning on bearings at G. It is evident, that as soon as the water sinks, the passage H will be opened, and the steam ascend into the whistle K, and likewise rush along the tube L, which has a clack-valve at C, opening in the direction of the darts. A bent tube, N N, joins the tube L, having an opening at M, and close to it a common clack-valve playing in a perpendicular direction; this tube, and the tube P joining it, terminate in openings above the grate.

The action of the mechanism is as follows:—The water entering freely at M, will fill the tubes L and N up to its own level. Suppose now the level of the water to fall, steam will enter the tube L, and some small part will escape through the whistle, thereby giving a signal; the greater part will rush along the tube L, and impel the water through N and P into the grate. The clack-valve at M will shut, and prevent the steam from escaping, as likewise the one at C, so that the steam shall not be able to return. Thus the fire will be either entirely extinguished or greatly lessened.

This plan is more particularly adapted to high pressure boilers.

## PILBROW'S CONDENSING CYLINDER ENGINE, MR. PILBROW IN ANSWER TO "S." AND "A. M

Sir,—I am indebted to "S." for the pains he has taken to examine the method of investigation, and amount of saving in the pamphlet, but I regret that he passed no opinion whether the engine itself would effect the object. I could get no information of the *present* practice, except that which did not bear the stamp of sufficient authority to rely upon and print; I was compelled to go to a certain, though an older authority. It was only in this way I could bring the subject properly before the public, to induce that discussion I have publicly sought, to obtain with accuracy the best performances, with all the benefits of modern improvements. It has effected my object, and I am now able correctly to dissect the present practice, and to determine how far it is superior to the older, from a comparison with engines of the first quality.

My opportunities of inspection have brought me to the conclusion, that in one respect there has been some improvement on Mr. Watt's practice, though not to the extent supposed by our present engineers. This improvement is the opening of the eduction valve previously to the termination of the stroke, by which the engine is somewhat a gainer, namely, by dividing the exhaustion between the two sides of the piston; and to get the maximum effect of this arrangement it must be exactly divided. This will give more power and duty than if the exhaustion

was wholly carried out upon one side of the piston, notwithstanding there is a loss by throwing away the steam before the completion of the stroke, a loss as much upon the one side as the other. Though these two losses, when added together, may not amount to so much as if the whole time was taken from one side of the piston, the object of such an arrangement is merely that the vertex of the crank's action (being the slowest of the pistons) should divide the *time* necessary for the evacuation of the cylinder, and thus be the gainer of the double advantage in the peculiar situation of the engine at that time. By this practice, when properly managed, I do consider they have been the gainers of from half, to one pound better mean exhaustion, and that the best engines now, when working under their best arrangement in this respect, have not more than what is equal to 2 lbs difference between the extreme condenser vacuum, and the main cylinder exhaustion; that is to say, they have but 1 lb upon the exhaustion side, and an equal loss upon the other, whereas, if they did not open the eduction valve till the end of the stroke, they would have had 2½ lbs, or 3 lbs difference. So that I now consider that I have only 2 lbs of difference to save by my engine, independent of the better vacuum that I can procure by the complete evacuation of *my* condenser every half stroke, at the *very lowest* amounting to half-a-pound, giving me 2½ lbs more effective power upon every square inch of my working piston from the same quantity of steam. But at the same time, when this extra quantity of power is not wanted, by carrying out the expansive principle to lessen it, I shall increase the *duty* in a much greater proportion.

Independently of this saving, the speed of my piston may be increased without any loss, to 400 feet per minute, thus diminishing weight, and saving first cost of the engine.

From the best authorities I find that the *Great Western's* engines, which "S." speaks of, when working at 600-horse power, (actual,) consume about 4½ lbs of coals per horse power per hour, which is lifting, in the Cornish phraseology, about 41,000,000 for a bushel of coals of 94 lbs; now this is only *one third* of the duty of the best Cornish lifting engines. What can account for the *whole* of this difference?

Upon that part of my paper respecting the compression of steam in the Cornish engines, "S." questions whether the pump-rods are of sufficient weight to balance the water, with or without weights. This does not affect the question. The engines referred to by Mr. Parkes and myself are those whose pumping stroke is effected by the weight of the pump-rods in "bob," therefore it seems clear that these rods, &c., must be equal to overcome the friction of engine and pumps, the weight of the column of water, &c. If so, I have said that when once in motion they would acquire a certain momentum, and, unless by some means brought gradually to rest, would strike the top of the cylinder, or elsewhere, to the injury of the machine. I merely meant to show that it is possible to shut in steam, as a cushion to bring the piston to rest, in such manner that, in some cases, it would be so compressed by the momentum as to exclude any possibility of *percussive* action by the next incoming steam. Such I know to have been the case to a considerable extent in some engines I have seen; but when it was so to any amount, the piston did not stop at the top of its stroke, but returned directly, and stopped at the bottom. I do not think that *all* the fifty-one engines have the pause at the top, as suggested by "S." Some do not pause at top at all; but all those engines that have done the greatest duty, when doing that duty, did pause at top; and when they work quicker, and consequently do not pause so long, or not at all, their duty suffers immediately in proportion.

I find "S." had founded his calculations in his former paper upon 17·75, which is taking our barometer at much above its average state. I had not done so, and did not notice that "S." had, when I said I thought he had given too high a mean. I had considered it at 17·5, taking the barometer at 14·5 lbs = 29·67 inches of mercury, about an average state for us. His mode of calculation is sufficiently correct for all practical purposes.

I cannot agree with "S." in adding ¾ lb to my vapour in the condensing

cylinder, for my cylinder will not be warmer, or so warm as the condenser of a marine engine, as it will be surrounded with cold water, and if it were, it would have only vapour of the elasticity due to the temperature of the water lying in it, which would be 93° = ¾lb altogether, instead of, as "S." says, 1 + ¾ = 1¾lbs.

At the same time I will admit that "S." has, perhaps, given me more than I may find in the 4lbs, so that his *conclusion* may not be far from the truth.

I beg also to thank "A. M." for his diagrams, which may be valuable to me. Will he oblige me with the following data, the first in particular, for at present both are useless.

The consumption of fuel per horse power per hour—the steam pressure—when cut off—the height of the barometer—the mean and extreme state of the condenser vacuum as shown by the gauge at the time—the temperature of the condensement—the number of feet the piston was travelling per minute, and the mean *steam* pressure as *shown by the indicator* upon the same card as the exhaustion was taken from.

The second diagram, and all diagrams should be accompanied with the same particulars, or they can be no guide for science to determine from. If not noted by "A. M." he will perhaps be good enough to take others in this way. No. 2 allows me sufficient gain, to make my engine valuable, therefore I will not touch upon that at present, but am, Sir,

Yours respectfully,
JAMES PILBROW.

Tottenham Green, October 11, 1841.

## PADDLE-WHEELS AND SCREW PROPELLERS.

Sir,—Some time since there was a long controversy carried on in your Magazine, on the comparative merits of the paddle-wheel and screw propeller, and, as the question was never satisfactorily settled, allow me to suggest a method which would probably satisfy all parties. Let any two boats be taken, one with the paddle-wheel, and the other with the screw. Let each engine make 1,000 strokes, and the distance be measured—this would be their actual duty. Calculate how far the wheel would have travelled had it been rolled along a solid body, and how far the screw would have gone had it been screwed through a solid body—and this would be the calculated duty. Then the differences of their calculated and actual duty would give the comparative merit of each.

I am, Sir, your obedient servant,
D. J.

October 4, 1841.

## LIFE AND LABOURS OF TELFORD.
## NO. XI.

[Continued from vol. xxxiv, page 439.]

### *The Nene Outfall, and North Level Drainage.*

In the more advanced period of his professional career, Telford was actively employed in improving the drainage of the immense fens on the eastern coast of England, an undertaking which from its extent, and the effects produced, may be looked upon as of national importance. The whole district of the fens, reckoning from Cambridge on the south, to a line drawn from Lincoln to Wainfleet on the north, is not less than sixty miles in length, by from twenty to thirty in breadth, occupying an area of five hundred and thirty square miles, or three hundred and forty thousand acres; but the operations conducted by Telford were chiefly designed for the amelioration of the more northerly division of this large and naturally fertile tract of country.

The new outfall for the waters of the river Nene was originally projected, in 1814, by the late Mr. John Rennie, and executed under the joint superintendence of himself and Telford; but the plan for the drainage of the "North Level" was due entirely to the latter. The works of both were carried on simultaneously—so complete was the confidence of Telford in the ultimate perfect success of the plan for the new outfall, though less practical engineers were full of doubt as to the result of a scheme which was then perfectly novel, and in no locality more so than in the district of the fens, where, reasoning *à priori*, the arts of drainage should be best understood. His confidence, however, appeared to have been well founded. The

river Nene now reaches the sea by a direct channel, over which a convenient bridge, connected with a good line of road, effects an always practicable communication between the counties of Norfolk and Lincoln, or, it may be said, between the eastern peninsula of England, and the whole of the midland counties. Previously, the only mode of transit was by boats, across a wide and dangerous estuary, passable only at certain times of the tide, and then at the utmost peril to life and property, in token of which it may be remembered that it was on this very spot King John sustained that heavy loss of all his cherished treasures, which, according to most historians, shortly after brought him to his death-bed. Similar, and even worse disasters have been common up to our own days, but now the passage is as safe and easy as the crossing of London Bridge. Besides this advantage, the improvement has enabled the land-owners to embank 1,500 acres of land from the sea, all of which now bear luxuriant crops of grain; while 2,000 acres more are already fit for enclosure, and 400 more rapidly becoming so.

Nor are the effects on the navigation of the river less beneficial. There is now a safe and daily communication between Wisbeach and the sea, at all times of tide and in all weathers, in place of the old and peculiarly tedious navigation, which was practicable only at spring tides, and with a fair wind, and then only for vessels of 60 tons. Ships of 400 tons now reach Sutton Wash at spring tides, and might even get up to Wisbeach itself, but for want of the comparatively trifling further improvements, which would suffice to make that town the emporium of Cambridge, Norfolk, and Lincoln shires; as it is, its trade, which before the new outfall amounted to 50,000 tons, has, since its opening, more than doubled, having reached to 108,000 tons per annum.

But the most important result of all is, that the water in the new channel ebbs 10 feet lower than it did in the old one, immediately opposite to the South Holland and North Level sluices, which are the outlets for the drainage of no less than a hundred thousand acres of fen land, lying between the rivers Nene and Welland. The consequences of this simple fact, unimportant as it might be in a less level country, are, that the means of natural and unassisted drainage are afforded to immense tracts of flat and fertile land, which, under the old system, were obliged to be cleared of their water by a most complicated, ineffective, and highly expensive arrangement of windmills, and (of late years) steam-engines. In nothing, perhaps, did the genius of Telford shine more brightly than in the complete revolution he effected in the whole system of fen drainage; and probably few of the stupendous works he superintended, will be found in the end to have been productive of greater national and individual benefit than those he carried into effect in the North Bedford Level.

In cutting an artificial canal, the engineer has every thing, as it were, within his own control; the means of overcoming his difficulties are before his eyes, and, with the aid of labour, within his reach. It is widely different in the case of natural rivers, and the subject, interesting as it is, has been strangely neglected until a very recent period. The reports of Smeaton and others, within even twenty years' date, show, that in such cases as that of the Nene, it was always recommended so to arrange the sluices as to shut out the waters of the sea, and prevent the tide from entering. So far all was well, but it seems to have been forgotten that while the sea was kept *out*, the land waters were also kept *in*, and thus the general level of the channel kept permanently higher. The error, in all probability, arose from the fact, that Dutch engineers have, generally, in past times, been employed in the drainage of the fens, as having had, beyond all contradiction, the largest experience in this line of any people on the face of the earth. Vermuyden and his companions naturally enough employed the same means which had been found effectual in their own country, and accordingly dammed up the mouths of every outfall with immense sluices to exclude the tide. This plan answers exceedingly well in Holland, where the rivers are no more than large drains, to take off the surface water from their own localities alone,

but it unfortunately happens that the flat lands of Lincolnshire, and the other fen counties receive the drainage, not of their own surfaces only, but of nine or ten of the adjoining more happily situated upland counties. The rivers from thence pour down, especially at some seasons, an immense body of fresh water, which must necessarily find its way to the sea through the dead level of the fens; and to this circumstance is owing the comparative failure of the ingenious Dutchmen. Their whole thoughts were bent on keeping out their only enemy at home, the sea, while it was, in fact, equally necessary to provide for the escape of the landward waters also, and thus the erection of sluices at the mouths of our rivers, proved inferior in absurdity only to the famous Dutch blunder of surrounding the capital of Java with canals, in the fashion of Amsterdam, in spite of the *trifling* difference of climate, a measure which places Batavia, in point of health, on a level with Sierra Leone.

Error is inveterate, and it is only within a very few years that we have begun to rid ourselves of the consequences of the Dutchmen's too faithful adherence to the good old method, chiefly through the exertions of Rennie and Telford, especially the latter. The method employed (every thing else being prepared accordingly) was simply to remove, totally and entirely, the obstructions placed at the mouth of the Nene, and thus to give free egress to the fresh waters, and free ingress to the tidal waters of the sea, guarding against the risk of inundation by raising the banks of the river to a sufficient distance inland. Besides this, the course of the river, formerly excessively tortuous, was made as straight as possible, so as to lose no advantage of "downfall." Three inches fall in a mile will cause water to move slowly; 4 inches will be sufficient for ordinary drainage purposes, so that if the sill (or threshold) of a sluice be but one yard higher than is necessary, it will prevent the drainage of a tract of country for twelve miles above it. On the same principle, if an outlet, obstructed by the caprice of the winds and tides, shall double its strength by creeping through a crooked channel, a 3 inch fall may become equivalent to 1 inch only, which is entirely inefficient for every purpose. This very state of things was the actual effect of the measures the Dutch engineers hit upon, the result being, as we have seen, that the sills of the sluices were absolutely no less than 10 feet above the level of the natural drainage, thus compelling thousands of acres to be freed of their water by artificial means at an enormous expense, for which there was no necessity. The fens were, moreover, subject to ruinous inundations whenever an unusual fall of rain in the upland country sent an unlooked for flood of water to find its slow way out to sea through the elaborate artificial obstructions, in its course carrying with it no small portion of the crops and flocks of the unfortunate dwellers in the "level."

All this is now changed. The straightness of the river's course insures no loss of downfall, and the water both from land and sea, is turned to account most efficiently as a scourer and deepener of the river's bed. The Nene has, in fact, been compelled to become the excavator of its own channel, and has done its work to admiration. The operation was to be seen rapidly going on in the summer and autumn of 1830, when, all the preparations being complete, the river was turned into the new course prepared for it. With a view to this, the old channel was dammed up in July of that year, and the water turned into the new one. So great was the effect, that the hitherto slow and placid stream became a rapid and impetuous torrent, carrying away the sand, where it met the sea, to the depth of four feet below its bottom. By a law of nature this excavation will recede further and further inland, till the bed of the river shall have a regular fall throughout, and when that shall have taken place, Wisbeach will be accessible to ships of the largest burden; at present, however, these go no higher than Sutton Wash, (where the bridge crosses,) at which place docks and warehouses have already made their appearance, and form the nucleus of what, in all probability, will become an important harbour. Above this point there are from 180,000, to 200,000 acres of fen land, which, in a few years, will retain nothing of their ancient nature,

except exuberant fertility, and this, without the assistance of the cumbersome and costly mass of windmills, and other machinery, which the old system required to effect a very distant assimilation to their present state.

Telford could not reflect without complacency on the success of his exertions in the drainage of the North Level, by which he recalled into being a natural outfall, which had not only been neglected, but impeded for many generations by a labyrinth of drains and sluices, the expense of maintaining which, more than any experienced utility, served to persuade the fen proprietors that they were essential, instead of detrimental to the object they were undoubtedly *intended* to promote. The errors of the old engineers are now happily exploded, and there is no danger of their being revived. The effects of the recent improvements on the pecuniary prospects of the landowners concerned are too decided to permit any fear of this, and now that they have got rid of their old incubus, without any fatal consequences, they are not likely to let themselves be sluice-ridden again. If it be true, as is asserted, that one great proprietor estimated his share of the expenses, altogether £650,000, at £100,000, and his ultimate profits at just double the sum, or 200 per cent, there need be no wonder that the operations of Rennie and Telford, looked upon at first with distrust and dislike, have placed their names at the summit of popularity in the great district of the fens.

Improvement is, in fact, still rapidly progressing in the same direction. More and more land continues to be reclaimed, and the outfalls of the other rivers will doubtless receive all the improvement of which they are susceptible. So enlarged have the minds of the dwellers of the low lands become by the magnitude of the operations they have witnessed, that a scheme was a short time ago on foot, for adding by embankment a surface of 100,000 acres to the soil of Britain, and erecting it into a new shire, by the very badly chosen title of "Victoria County." This speculation has, however, fallen to the ground; it always partook too much of a Stock Exchange character, and its being under the presidency of a nobleman *well known on the turf*, did not add to the solidity of its character. Should the idea be revived, it might, perhaps, be as well for the shareholders to display their respect for the memory of the man who demonstrated the reality and practicability of the way to wealth which lay before them. Few names could be selected more appropriate or better sounding than that of THE COUNTY OF TELFORD.

## ON THE EVAPORATIVE POWERS OF BOILERS.

Mr. C. W. Williams, to whose plans for the prevention of smoke we have of late so frequently had occasion to refer with approbation, read last week a paper at the Polytechnic Society of Liverpool, on increasing the evaporative powers of boilers, in which he successfully illustrated a mode, not hitherto practised, of effecting this object, but from which, it appears, very extraordinary results may be obtained. The following is an outline, with which we have been favoured, of this valuable communication:—

Mr. Williams observed, that in considering the use of fuel, there are two leading divisions under which the subject should be examined, and which, though unhappily confounded, should also be kept distinct. First, that which regards the *generation* of heat; and, secondly, its judicious *application*—the former being a chemical question; the latter, a mechanical one. As regards the *generation* of heat from fuel, we have to examine its several constituents, and the nature and properties of each—their respective chemical affinities—and the whole range of conditions under which they combine with the oxygen from the air in the process of combustion; these are all chemical considerations. In the *application*, however, of the heat so obtained, and the rendering it available for practical purposes, our attention should be directed to a very different class of objects. In this we are called on to examine the several modes by which heat may be communicated to bodies—the nature of those bodies, as regards their susceptibilities of receiving and transmitting it—the construction and size of the vessels in which the operation of transmission is effected, and their most judicious ar-

rangement; the object being to effect this transmission of heat to the water inside a boiler, in the largest quantity—in the shortest time, and in the smallest space: in a word, how best to increase their evaporative power.

For these purposes heat must be considered in two distinct points of view, namely, in connection with solid matter, and as distinct from it; a division which leads us directly to the two recognised modes for effecting its communication: viz., by *radiation*, and by *conduction*. If the hand be presented, within a given distance, to a heated body, it directly receives a portion of heat from the latter. This is by *radiation*, or the power which heat possesses of passing from one body to another, without their being in contact. But if the hand be brought into contact with a heated body, as a plate of iron, a much greater degree of heat will be received, arising from the faculty which bodies possess of transmitting heat through their fibres or solid parts. This is called *conduction*. In the construction of boilers and furnaces, both these modes of communication are brought into action; and it becomes a question of great importance, whether we avail ourselves of either, or both, to the greatest possible extent. The illustrations presented by Mr. W. went to prove that this is not the case.

With respect to radiation, the sphere of its influence is necessarily confined to the immediate vicinity of the furnace; the rays of heat, like those of light, passing only in straight lines, as *radii*, from any given centre. With respect to conduction, however, there are other considerations which demand attention, as on these will be found to depend the means of effecting a practical improvement in boilers.

If a thermometer be held near to the flame of a candle, it at once indicates an accession of heat by the force of radiation: but if held, even at a considerable distance, above the flame, it then receives heat from a different cause. In this case, the heat is *carried* by the gases which are the products of combustion to the thermometer, when it is passed through the glass by the faculty of conduction. Here we see that the matter of heat, though it can be *radiated* in direct lines alone, may yet be *carried* in any direction, and to a great distance; and to this is attributable the efficiency of all parts of a boiler apart from the furnace in which the heat is generated. Thus we are led to distinguish between the *carrying* power of the gaseous matter passing along the flues, and the *conducting* power of the metallic plates forming those flues. By the former, the heat is conveyed and distributed along the entire surface of the plates; and by the latter, it is conducted through those plates to the water, by which it is to be absorbed.

Much might here be said respecting this carrying power, and the necessity for distinguishing it from the power of transmitting or surrendering it up to other bodies: for it does not follow that the best carrier is the best transmitter. In many respects, indeed, these qualities are directly opposed: as for instance, in atmospheric air and steam: both are excellent carriers of heat, while their transmitting power, or the facility with which they surrender it, are essentially different. It becomes then a question of deep interest how far the bodies we employ may not carry the heat too well, by carrying it too far: and, in fact, *carrying it altogether away by the chimney shaft.*

In an elaborate paper presented to the Society of Arts for Scotland, by the President, Doctor Fyfe, the distinctions here drawn, and the effect of this excess in the carrying power of the gaseous products of combustion seem to have been wholly overlooked; hence the learned President has been led to results essentially erroneous. This paper was, "On the Evaporative Power of different kinds of Coal;" but neglecting to take any account of the quantities of heat or heating matter so carried away and lost, Dr. Fyfe comes to the conclusion that, not only does the evaporative power of the several kinds of fuel employed bear a ratio to the proportion of "the fixed carbon" they contain, but adds, that "it would appear to be almost in the exact ratio of its quantity in each." To this conclusion, Mr. Williams observed, that he respectfully, but most decidedly demurred, adding, that he considered it not only a dangerous enunciation, coming from so high an authority, but, both practically and chemically erroneous. To prevent the evil which pre-

vails to a mischievous extent in almost all our boilers, arising from the great loss of heat so carried away, and the disproportion between this carrying power of the gases, and the absorbing and conducting power of boilers, was the object of the present communication.

Hitherto, in the construction of boilers, attention has been exclusively given to the extending their flues, with the view of presenting a larger absorbing surface of plate to the action of the heat, and calculating the transmitting power by the number of superficial feet so presented. We seem in this to have wholly overlooked the practicability of increasing the receiving and conducting power of any given superficial area of these metallic plates. There is, however, a modification of this principle of conduction, which is well entitled to consideration, and it appears strange, that we have so long neglected the powerful aid which it affords in increasing the evaporative power of boilers.

When the gases, which are the products of combustion, (and which contain all the heat arising from such combustion,) pass along through the flues, impinging against the surface of their metallic plates, the heat is conducted in a direction at right angles to these surfaces to the water in the boiler. This, then, may be called *transverse* conduction, as the heat passes transversely through those plates.* But if we heat one end of a rod of iron, we find a very large conducting power is brought into action by reason of the heat passing *longitudinally* along its fibres, and with great rapidity. This may, therefore, be called *longitudinal* conduction, in contradistinction to the former *transverse* conduction. Now, this is the power, or modification of the power of metallic conduction, which it is proposed shall be rendered available, and the application of which, is at once so practicable and effective.

Independently of the conducting power which a metallic pin of any size may have, it is manifest that it possesses an absorbing, or receiving power, in proportion to its length, as well as its diameter; and this it is, which gives it an available application in the flues of boilers. Suppose an iron or copper pin of half an inch in diameter, inserted in a metallic plate, and projecting 3 inches beyond its surface. In that case, a portion of such surface plate, equal to a circle of but half an inch in diameter is occupied, while the pin itself presents a heat-receiving surface equal to $4\frac{1}{2}$ inches; or, as 9 to 1. If then, this projection be presented to the stream of heated gaseous matter in the flue, we obtain an effective heat-receiving surface, nine times greater than the area of the plate which the pin occupies. In other words, the half inch circular portion of the flue plate, which such pin has displaced, is thus made to possess the faculty of transmitting as much heat as is received and absorbed by nine half inches superficial.

Mr. Williams then exhibited a set of evaporative pans, which strikingly proved the correctness of the preceding reasoning.

[The conclusion of this interesting paper, with some illustrative diagrams, we shall give in our next number.]

STEAM CARRIAGES ON COMMON ROADS.

Sir,—In a former number, (948,) you have inserted a letter of mine, regarding the cost of propulsion for common road steam-carriages, which I clearly prove to be only 2*d*. a mile, versus the 2*s*. 6*d*. or 3*s*. for fast four-horse coaches.

But, Sir, you have appended a note, in which you reiterate your "*veto*" against my assertion, and that of many other eye-witnesses, such as Messrs. Gordon, Hullmandel, Lord Tweeddale, &c., &c., "that I ran my first steam-carriage daily, during eighteen months, without any repairs being required or made *to the boiler or the engines*."

The words "every day" must certainly, as you have it, be taken "*cum grano salis*." We have fifty-two Lord's-days in the year, which are not *common road steam days*. Then, my friend Squire, being of an obstinate temperament, insisted that *he* could forge a five-inch double crank axle by sledge-hammers. I do not say that the thing is impossible; but, although I employed six sturdy firemen, with 24 lb. hammers, one axle only, out of five, proved sound! Each thus made cost me £60; whereas an infallible axle, five inches in diameter, made under a tilt-hammer of two tons

weight, costs only £25, and is "as sound as wax."

Now, Sir, I must allow that these interruptions to the running of the carriage, whilst new axles were making, militate against the *literal* interpretation of "every day," or "daily," which you object to.

Then, again, we often had the fire lit, ready to start, at three o'clock, according to our advertisements, when the heavy rains of June and July 1833 and 1834 would set in about mid-day, and so prevent our visitors from coming. Then, after waiting an hour or so, to save fuel, we pulled it out of the furnace, and left the poor carriage, exposed to the weather as it was, during eighteen months, in the middle of the yard, without any other injury than the rusting of the boiler-casings. But, even under these rainy circumstances, we often took a "one-fire trip," (twelve miles,) if only one or two visitors came near to time. I have no space to apologize, but am yours sincerely,

October 11, 1841. MACERONI.

P.S.—In consequence of a dispute between the manufacturing engineer, Mr. Beale, the affairs of the company I last formed are at a stand-still. I had agreed to furnish the carriages at £800 each. Mr. Beale has charged £1,700 for the first. The committee refuse to pay: Mr. Beale refuses to let the carriage go out any more. I am the greatest sufferer, as I have lost every thing—furniture, books, manuscripts, models—all! Just as the difference arose between Mr. Beale and the committee, I was to have received £2700 on account of my mileage.

I am now in a state of great distress. Still, I am trying to form another company, with a distinct boiler. But at every step I am met by the Remora of destitution.

## MESSRS. PENN AND SONS' IMPROVED FEED APPARATUS—PROFESSOR HOBBS' PUMP.

Dear Sir,—I regret extremely, that amongst your numerous and intelligent correspondents, no one has thought it worth while to notice the new and excellent contrivance which has been adopted, on board the *Father Thames*, for the purpose of lessening the extreme labour of the stokers who are employed on board that vessel. Every person must be aware of the intense heat to which these men are subjected, especially, whilst performing the arduous duty of pumping the water into the boiler by *hand*, whilst the engines are in a state of rest. Now, Sir, the manufacturing engineers (Messrs. Penn and Sons,) with a regard for the comfort of the stokers, which does them infinite credit, have introduced a small engine into this vessel, which, being driven by the steam which would otherwise be blown off from the safety-valve, incurs no extra expenditure of fuel, and by means equally simple and effective, performs the work of two stokers, whilst it occupies a space of only 15 inches by 12, independently of the connecting pipes. There is a pump attached to it which struck me as one of the most unique specimens of workmanship which I have ever seen, performing its work with a precision perfectly astonishing. Let us not forget, Sir, in our admiration of the workmanship, to give due credit to the inventor of this pump (which is on an entirely new principle): it is the invention of Professor Hobbs of Hamburg, who, notwithstanding he is a foreigner, I hope will reap the benefit of his ingenious contrivance in some more substantial manner than that of being eulogised in our morning papers, which, I have great pleasure in stating, have taken the matter up in a manner which does them great credit. I hope, Sir, you will not consider this communication as too trifling for your valuable periodical, having always had the reputation of being impartial, and anxious to facilitate the general adoption of any invention which promises to be generally useful to mankind. A pump, Sir, is in itself but a trifling machine, but, "*homo sum; humani nihil a me alienum puto*," is, I believe, an excellent maxim for those who wish to live and learn: could you but see the stokers at work in an engine room, so cramped as that of the *Father Thames*, you would agree with me, that the prime cost of a machine, like that which they have now adopted, ought not to be an impediment to their universal and immediate adoption.

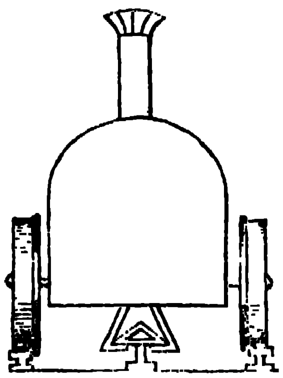
By giving this communication a corner in your excellent Magazine, you will greatly oblige, Sir, an Old Subscriber, and a

PHILANTHROPIST,

Greenwich, October 11, 1841.

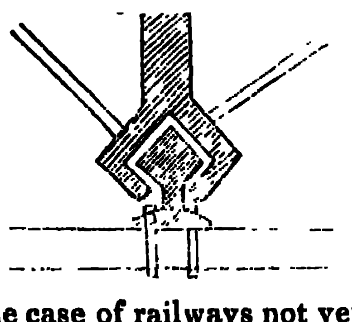
## PLAN FOR THE PREVENTION OF RAILWAY ACCIDENTS.

Fig. 1.



Sir,—So many accidents are continually occurring on railways by the engines running off the rails—so much property is damaged and so much confidence is lost daily by the public in their safety—that I think it high time means should be taken to prevent it. The plan to which I have now to invite the public attention, would make it a literal *impossibility* for the engine or carriages of a train to get off the rails unless indeed they tear the rails up, —which is not a very likely case. Prefixed (fig. 1.) is a section of railway and engine, with the addition of a third rail, which is rather higher and larger than the others. This third rail is laid down in the centre of the two *wheel* rails, and acts as a guide rail, the engine, tender or carriage having affixed to them claws, which embrace the rail, but without touching it. When the engine has a tendency to fly off the rails, the guide rail would effectually check it; and thus prevent by far the greater number of the accidents which occur in railway travelling. Railways might then be traversed at the highest rates of speed without any fear.

Fig. 2.



In the case of railways not yet formed, an iron tram-way for the wheels to run upon, would be cheaper than edge rails. And as the guide rail has no weight to bear, it might be of cast iron, and hollow, which would lessen the expense about 30 per cent.

Fig. 2 is a more enlarged view of the guide and claw.

I am, Sir, &c.

D. J.

October 4, 1841.

## WORKING ROTATIVE ENGINES EXPANSIVELY.

Sir,—Mr. Cheverton seems, in No. 944, to have called on me for a correction of my opinions, "as to the great advantages to be derived from more expansion of steam than is usually practised."

I certainly have referred to the power to be theoretically derived from expansion as far as six times, deduced from the common theory, but I never expressed an opinion that it could be realized in rotative engines—conceiving three times expansion will be the limit for a cranked engine, though perhaps four times may be practicable where two engines are employed; subject, however, to the condition, that high steam will not be objectionable. Theory concurs in the Cornish practice of six, or even more expansions, wherever momentum can be imparted to massive pump rods, and be again completely restored at the end of each stroke.

It is probable that my expressions have been misunderstood.

There is, however, one opinion, which I am desirous of correcting—I mean the direct reference to rules derived from the hyperbolic curve, without correction for the diminishing temperature and pressure of steam on expansion, in a greater ratio than is due to the law derived from that source, that the pressure is inversely as the volume. The error is small for two expansions, but is of more importance as expansion is increased, and I hold Mr. Cheverton's clear explanation of this point, and of the practical difficulties of increased expansion, as of great value. I did not wish to introduce this minor, but essential correction for expansion. Having alluded in a previous letter to the different theoretic power of two and six expansions, I did not refer to it again,

but I was much pleased to observe, that Mr. Cheverton has distinctly shown the confusion and error that have arisen from a change of the conditions of expansion in the comparative calculations by Mr. Boyman.

I fear in my answer to Mr. Pilbrow I have attributed to him incorrectly an assertion, that the improved vacuum due to the pause in Cornish engines is the principal cause of their great duty, instead of one of the principal causes in connexion with expansion as the other. I remain, Sir,

Your obedient servant,

S.

October 6, 1841.

DESCRIPTION OF THE METHODS ADOPTED FOR RAISING AND SUSTAINING THE SUNKEN ROOF OF ST. GEORGE'S CHURCH, DUBLIN. BY ROBERT MALLET, ASSOC. INST. C. E.

St. George's parish church, one of the finest ecclesiastical edifices in the city of Dublin, was completed in the year 1802, from the designs of the late Francis Johnston, Architect to the Board of Works at that time, at a cost of about 90,000*l*.

The church had not been built many years, before the roof, which was covered with tun slating and copper, gradually sunk in several places, by which the cornices at the flank wall were pushed several inches outwards. The subsidence slowly but continually increased. The ceiling cracked in various places, the ornamental stucco work began to drop off, and in the year 1836 the state of the roof was such, that the church was deemed unsafe for use, and was shut up.

Messrs. John and Robert Mallet were consulted as to the practicability of restoring the roof. In November, 1836, they reported that they considered the ceiling might be preserved, and described the manner in which they proposed to accomplish it.

The mode proposed consisted in interweaving with and adapting to the timber framing of the roof, a system of metallic framing, so arranged, that all strain or stress should be removed from the former, and borne by the latter, as well as removing all lateral pressure from the walls of the building.

A careful survey of the roof showed that the ends of several of the principals were unsound. A small hole was then bored through the ceiling, close to each queen-post, and a deal rod, ½ an inch square, dropped through each. These rods were all of equal length, and their upper ends were secured level with the top surface of the tye-beam of each principal; then with a levelling instrument placed in the gallery, observations were taken, and the exact amount of the deflection of the framing ascertained. The variation was considerable, but the greatest amount of depression was found to be 5½ inches. The whole roof was strained and distorted, and was so unsafe that the slightest effort caused vibration throughout. The causes of this failure appeared to be threefold: a radical want of strength in the framing of the roof; secondly, the employment of unfit tye-beams, which having been constructed during the Continental war, when timber was scarce and dear, were formed almost wholly of short lengths, averaging not more than 20 feet, lapped and scarfed; thirdly, in the queen-posts having been badly constructed and ill placed.

The stone corbels, which supported the oak cantilevers, being originally cut almost through to receive the wall-plate, were nearly all broken in the middle. It was proposed, therefore, to remove the oak cantilevers and stone corbels, and to cut away the timber wall-plate beneath each principal, to level up the wall, placing a suitable cast-iron abutment piece at each end, and to spring from side to side a cast-iron arch, in "double flitches," connected through the spaces of the timber framing by hollow distant pieces, and also by a certain number of equidistant cross-heads, from which should drop down vertical suspending rods, capable of being adjusted in length, and connected by the tye-beam of the principal, so that being drawn up straight, and the respective parts secured, the weight of the whole roof would be transferred through the framing to the tye-beams; whilst they being hung from the system of suspension rods of the cast-iron arches, which would thus sustain the whole load, and their abutments being held together by the tye-bars in the chord line, the load would bear vertically upon the walls.

It was then determined to raise the roof and ceiling by forces applied from below; to cut away the rotten ends of the principals and to reconnect them with the walls by a modification of the cantilever bracket, invented by Mr. Alfred Ainger, and described in the Transactions of the Society of Arts (vol. 42). The whole of the oak cantilevers and stone corbels were to be removed as useless incumbrances.

The total weight of the roof being about 133 tons, each framed principal would sustain about 16½ tons, and each vertical suspending rod about 1½ ton.

Although the weight of material in this roof and ceiling may be considered uniformly

distributed, it was impossible to foresee what change might be effected in the framing by forcing the ceiling and roof up to a level line, or what amount of force might bear upon particular points, from the elasticity of the materials being thus forcibly constrained. It hence became a matter of prudence to provide in all parts a large surplus of strength, bearing in mind that, in any complete system, "the strength of the whole is limited by that of the weakest part, and thus that partial strength becomes total weakness." The dimensions of the scantling were accordingly so calculated that the utmost strain upon it should not exceed 4·5 tons per square inch, considering 9 tons to be the practical limit to which wrought iron might be exposed.

After giving the formulæ for calculating the strains upon the different parts of the roof, with the reasons why the theoretical dimensions were in some instances departed from, the author apologises for entering so much into detail of the construction, quoting at the same time the writings of Smeaton and Telford, as abounding in the richest details of theoretic deduction, modified by practical judgment. He then proceeds to describe the means adopted.

Immediately beneath each of the fourteen queen-posts of the roof, an aperture of 30 inches square was cut through the floor of the church, and a pier of brick and cement built up from the arches of the vaults beneath to the level of the floor; on the top of each, a plate of cast iron was bedded, and upon each plate a block of oak timber about 4 inches thick.

Fourteen straight whole balks of Memel timber, each 3 feet shorter than the height of the church between the floor and the ceiling, with their extremities cut square and smooth, were placed vertically upon the blocks; upon this level a platform was laid; across the tops of the vertical balks, pieces of oak scantling were placed; fourteen powerful screw-jacks were then fixed, one beneath each queen-post, and the ceiling cut away for the points to bear directly upon the beams.

During the progress of these operations, the whole of the ceiling and roof framing had been carefully examined. The dust was removed from the joints and open mortices, &c., of the framing, and the cracks in the ceiling were cleared out by passing a fine whip saw through them, so as to permit their closing when the ceiling was raised to a plane surface.

The preparations being completed, the word was given to heave simultaneously upon the screw-jacks; the roof rose slowly and steadily, and as soon as any one of the small deal standard rods had reached the level plane, the motion of the screw-jack at that spot was stopped. In about two hours, the whole roof, together with the ceiling, was brought up level, without any accident or injury to any portion of the ceiling. The cracks in the latter as well as the joints and mortices of the framing were found to be nearly all closed. Some slates were broken, and the copper of the platform, which before was wrinkled and loose, was now found to be drawn tight over the timber sheathing.

The roof being thus supported from beneath, the masonry was cut out round the ends of the principals; the oak cantilevers, and corbels of granite, and the rotten ends of the timbers, within a few inches of the inside face of the walls, were also removed.

The cantilever and abutment castings were now applied, and bedded with lead and oil putty, on blocks of stone set at the level of the under side of the tye-beams, on footings of brick and cement. The chord-bars were next placed, and temporarily adjusted by means of their screw nuts. The arch segments were put up in succession, their centre or key pieces bolted in, and the segments adjusted to them by means of wedges of African oak; the suspending rods were then hung on from the top shackles, and the junction made good with the tye-beams, by means of the lower cross-heads, stirrups, and shackles.

As soon as the whole system of the seven-arched frames was complete, and the cantilevers adjusted to the ends of the decayed timbers, standing lengths of pine rods were placed in right lines from centre to centre of each pair of abutment cross-bolts, and all the chord-bars and suspending-rods were brought up by means of their adjustment screws, until the united effort of the whole system had lifted and supported the entire roof and ceiling from the screw-jacks, on which they had previously rested, so that these latter all became loose.

The whole was now left quiet for some days, in order that every part might take its bearing, and that the sufficiency of the structure should be proved before the removal of the screw-jacks, &c., which remained within about $\frac{1}{8}$th of an inch of the blocks beneath the tye-beams, by which means, in case of accident, the amount of fall would have been limited to that small distance. The entire work, including the repairing the cracks in the ceiling, occupied little more than four months, and has never since required either alteration or repair.

The total amount of the contract for this work was £1362 6*s*. The repair of the injury done to the ceiling only amounted to £33 0*s*. 8*d*., and the damage done to the

slating, platform, flooring, &c., did not amount to more than an equal sum.

The total amount of cast and wrought iron in the structure was 21 tons 10 cwt. 2 qrs. 19 lb.

## THE SMOKE NUISANCE.

The Common Council of London lately appointed a Committee to inquire into the annoyance and nuisance arising from the smoke of manufactories, steam-boats, &c.; and the Committee having advertised for plans and suggestions on the subject, were favoured with communications from no less than forty-one different parties.

Of these, five propose the introduction, in various ways, of fresh air into the furnaces; four would remove the nuisance complained of by coking or charring the coal in furnaces previous to combustion; four suggest the introduction of a jet of steam, in conjunction with a jet of air, into the furnaces of steam-boilers; fifteen recommend the use of anthracite, or Welsh coal; one, (Mr. Oram,) prescribes a compressed fuel of his own invention; nine say they could, if they would, tell how the nuisance might be abated, but will not open their mouths, except on conditions; and three give general advice.

The committee report, (Sept. 15, 1841,) that it appears to them, "after a careful perusal" of these various communications, "to be *highly desirable* that the nuisance arising from the smoke of steam-engines and manufactories *should be abated;*" and that they have "no doubt a remedy *may be found*, which will remove the annoyance complained of, and be attended with economy to the owners of steam-engines and manufactories generally." Conclusions of great soundness, undoubtedly, but not much calculated, we fear, to raise the reputation of City Committees for originality of thought or clearness of judgment. Which, of all the plans laid before them, is the most deserving of adoption they do not venture to affirm; unless, indeed, we may infer, from a remark they incidentally make on the communication of Mr. C. W. Williams, (one of the first five,)—that it is of a "particularly valuable character"—that they incline to give that gentleman's the preference; which, if it be the fact, would be saying more for their good sense than any thing else their report contains. With an impartiality as undiscriminating as their wisdom, they have annexed to their report "*the whole* of the plans and communications" transmitted to them; and thus given circulation, at no small expense to their constituents, to a great deal of rubbish and nonsense.

The Committee conclude by recommending, that the Corporation should "present petitions to both Houses of Parliament, complaining of such nuisance and annoyance, and praying that a law may be passed to prevent a continuance of the same." The Committee seem, evidently, not to be aware that there is already a "law" against the nuisance, which, but for certain defects in the means provided for putting it in force, would have long since put an end to the evil. All that is wanted is, a more summary mode of proceeding, and the appointment of some public prosecutor to put the law in force.

## ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

*** *Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for that purpose.*

JONATHAN BEILBY, OF YORK, BREWER, *for improvements in brewing.* October 5, 1841.

The process of mashing having been performed in the usual manner, the worts are turned into a high-pressure boiler, set in brickwork, its upper part being partly surrounded by a jacket or casing, to which cold water can be admitted from a tank when desired. Within the boiler there is a tube containing mercury, and furnished with a thermometer, or heat gauge. On the worts being admitted to this boiler, the heat is raised under pressure to 250° or 260° of Fahrenheit, which is usually accomplished in about fifteen minutes after the liquor boils. The fire is then instantly extinguished, and cold water let into the casing of the boiler, which in about fifteen minutes reduces the temperature of the worts sufficiently to allow of their removal to the coolers.

The claim is, 1. To rapidly heating of the worts to a high temperature, (from 250° to 260° Fahr.,) under suitable pressure, when taken from the mash-tun, and placed with the hops in the boiler to be boiled.

2. To rapidly cooling the worts down, as soon as they have reached that temperature, to the usual temperature, in order that they may be conveyed into the ordinary coolers, whereby a great saving of fuel and time is effected, and an equally perfect extract obtained, as by the usual slow boiling process in open boilers, or under very low pressure.

JAMES ANDERSON, OF NEWCASTLE, ENGINEER, *for improvements in windlasses.* Enrolment Office, October 5, 1841.

A worm-wheel is placed on each end of the windlass, above which is a winch pro-

vided with two corresponding wheels, the weight-bar of which has a ratchet wheel at each end, to prevent the return of the roll. Two endless screws, turned by suitable handles, shift in or out of gear of the windlass or winch, by means of sliding bearings and keys contained in carriages bolted to the windlass. The windlass and winch may be constructed together or separate, and by means of the sliding bearings, they may be worked both together or singly.

HENRY M'EVOY, OF GRAHAM-STREET, BIRMINGHAM, HOOK-AND-EYE MAKER, *for improvements in fastenings for bands, straps, and parts of wearing apparel.* Enrolment Office, October 5, 1841.

This fastening is a substitute for buckles, and may be applied to harness, carriage furniture, and wearing apparel.

It is described as applied to trowser-straps. A small metal plate has a piece cut out of the middle, and in the centre of this opening there is a spring tongue, sufficiently elastic to return to its original position after being forced away by the introduction of a staple. This metal plate is enclosed and protected by a shield, the middle part of which is raised, and its extreme edge bent so as to form an inlet for its reception, and also to provide sufficient space for the free action of the tongue.

A square hole being cut in the strap, a plate and shield are secured over it by three rivets.

At the bottoms of the legs of the trousers two metal plates, called "tops," are attached, to the lower end of which a staple is fastened, partaking slightly of a hooked form. This staple being placed immediately over the spring, and gently forced down, causes it to give way, returning, after the staple has passed it, to its original position, and entering the square hole in the staple, prevents its withdrawal. To detach the strap, the upper part of the top is pressed inwards, and the staple being made to act against the spring, it gives way outward and releases the staple.

JOSEPH WILSON NUTTALL, OF BELPER, DERBYSHIRE, DRAPER, AND HENRY HOLDEN, OF THE SAME PLACE, TAILOR, *for improved apparatus to be attached to trousers, commonly called trouser-straps.*—Petty Bag Office, October 5, 1841.

To each side of the trouser-legs a flat piece of metal is attached, having a bent tongue or hook, and to each end of the strap an eye or staple is connected, its upper edge being turned over nearly at right angles, so as to form a lip.

To connect these together, the staple is placed horizontally, so as to enable its lip to slide down between the tongue and its plate, and when so connected, the staple hangs down without any liability to rise, or slip out, its lip being wider than the passage between the upper part of the tongue and its plate.

Another fastening consists of a straight bar of metal, with the corners rounded off, which is attached to the trousers, having at each end a notch, covered by a flat spring slightly turned up at its ends. To the strap a bar is connected, having at each end a hook, or link jointed, which are passed over the ends of the straight bar into the notches, where they are held by the spring. In order to detach the strap, the end of the spring is raised, and the loops slide off the ends of the bar.

WILLIAM JAMES BARSHAM, OF BOW, MIDDLESEX, GENTLEMAN, *for improvements in fastening buttons, and other articles, on wearing apparel, and other descriptions of goods and manufactures.*—Enrolment Office, October 5, 1841.

The first improvement consists in a mode of fastening buttons on garments by means of a spring-catch. Its application to brace-buttons is as follows. A recess is formed in the face of the button to receive a spring-catch, and the edges of the recess are under cut, so that when the catch is sprung into the recess it cannot work out. The spring-catch is in form of a ring with a piece cut out of it, the greater part of the opening being occupied by a tongue, which projects across the ring. The button is attached to the garment by a shank resembling a small button, the eye of the shank being passed through the cloth from the inside, and through a hole in the centre of the button; the spring-catch is then placed in the recess, with its tongue through the eye of the shank, by which means the button is instantly secured.

In fastening ordinary coat-buttons, their shanks supply the place of the eye or shank before mentioned, and the brace-button and spring-catch is then placed inside the coat as a fastening to the former.

The second improvement consists in forming brace-buttons, so, that in fastening them on, they may stand off from the garment, and yet have the thread by which they are sewed on amply protected. For this purpose, a hollow stem is placed between the button and the garment, (the stem being either separate, or in one piece with the button,) by which the thread is inclosed and protected. Other modes of protecting the thread are also shown.

The claim is, 1. To the mode of employing a spring-catch with a button, and a suitable eye or shank, as described.

2. To the mode of applying hollow stems in fixing buttons as described.

JOSEPH APSEY, OF CORNWALL-ROAD, LAMBETH, ENGINEER, *for improvements in*

*the construction of flues for steam-engine boilers and other furnaces.* Enrolment Office, October 6, 1841.

This improvement consists in surrounding the whole outer surface of the boiler, (whatever its form or position,) with the flues, without any regard to the water line. But the outlet of such flues to the chimney, (contrary to the usual practice,) is to be at a point below the water line of the boiler. So that, although the flues are above the water-line, the flow or rush of the flame through them will not be higher than the outlet, and all the space above that point will be stagnant heated air, incapable of injuring the metal of the boiler.

The claim is to the mode of constructing flues of steam-engine and other boiler furnaces, whereby the same are carried above the water-line of the boilers, and the outlet into the chimney is found below the water-line of the boilers, as described.



## NOTES AND NOTICES.

*Gas at the Antipodes.*—The *Colonial Gazette* announces the lighting of Sydney by gas, and points to it as a striking instance of the enterprize so characteristic of Englishmen, that they should have been the means of introducing "one of the most brilliant inventions of modern times into one of the newest and remotest settlements of the globe, while the long-established cities of South America and India are still unenlightened by it."

*Nitrate of Soda*, which is now extensively used as a manure, is often adulterated with common salt, which does not cost one-tenth of the price. To detect the adulteration, throw a small quantity of the article into the fire; if it contains salt, it will produce a crackling noise; if pure, it will melt rapidly, with a low hissing sound.

*The largest library* in Great Britain is that in the British Museum, which contains about 225,000 printed books; but there are no less than eight libraries on the Continent which surpass it, namely, Paris, 700,000 books; Munich, 500,000; St. Petersburgh, 400,000; Copenhagen, 400,000; Vienna, 350,000; Naples, 310,000; Dresden, 300,000; Gottingen, 300,000; Berlin, 250,000. In valuable manuscripts, however, our national library is richer than any other, that of France excepted—the former containing 22,500, and the latter 80,000.

*A New Calculating Machine* has been invented by a Dr. Roth, of Paris, and patented in this country by a Mr. Wertheimer, which, the *Times* states, performs sums in addition, subtraction, multiplication, and division, with unerring exactness. Mr. Babbage, our own great experimenter in this line, is stated to have expressed his most unqualified admiration of this novel machine.

*Corn from Seed 2,000 Years old.*—At the late annual dinner of the South-west Middlesex Agricultural Association, Mr. H. Pownall produced a head of corn, which he said had been grown from germ found within the covering of an Egyptian mummy, within which it had been enclosed for upwards of 2,000 years.

*Improvement in the Piano.*—At the sitting of the French Academy on the 4th instant, an instrument of the pianoforte kind was introduced to the notice of the members. Its inventor, M. Isoard, has long devoted his attention to a kind of combination of the effects which would result from the hammer of the pianoforte and the bow of the violin, in producing sharply, and then in prolonging, any given note made by the vibration of strings. The principle of the invention is this—that the sound is first produced by a hammer, as in the pianoforte, striking a string, and then the vibrations of the string are continued with the same intensity for any interval of time by the admission of a current of air, which produces a similar effect to what the drawing of a violin bow over the string would occasion. The introduction of a bow was first tried, but was found too difficult of application; and the action of air, by an ingenious mechanical contrivance, was then substituted. The effect of the instrument was quite commensurate with the skill of the inventor, the sounds being prolonged *ad libitum*, and giving to notes all the swell and compass of the organ.—*Galignani's Messenger.*

*The Devastation* steam-frigate, 1,000 tons burden, recently launched from Woolwich Dock-yard, has been fitted with double cylinder engines, of 400 horses' power, by Messrs. Maudslays and Field, and also with the paddle-wheel connecting and disconnecting apparatus, lately patented by Mr. J. Maudslay. The engines of this vessel, as compared with those of other vessels previously fitted by this eminent firm, are stated to occupy one-fifth less room, to be one-fifth less in weight, and to consume one-fifth less fuel. The vessel made an experimental trip down the river on Tuesday last, when the working of the machinery, in all its parts, gave the greatest satisfaction to a numerous party of naval and scientific gentlemen assembled on the occasion. An average speed of 11½ miles was obtained, which is expected to be increased to 12 when the engines are worked at their full power. The armament of the vessel is to consist of two 10-inch, and four 32-pounder guns, placed on circular turn-plates, so that they may be moved round and fired in every direction.

*Ancient and Modern Travelling.*—At the recent opening of the Strasburgh railway, a grand dinner was given on the occasion. Among a number of appropriate inscriptions on the walls of the room was the following:—"In 1500, the journey from Mulhausen to Strasburgh occupied eight days; in 1600, six days; in 1700, four days; in 1800, two days; in 1811, two *hours!*"

*Artesian Well at Southampton.*—The works of the Artesian well on the common are now proceeding very favourably; the contractors have got to the depth of 430 feet. Should no untoward accident happen, it is expected the works will be completed by the beginning of next summer.—*Hampshire Telegraph.*

*Superiority of the Cornish Boiler.*—Mr. William Tonkin, engineer, from Redruth, Cornwall, has lately substituted a Cornish boiler of his manufacture for the old waggon boiler, at the Portsmouth Water-works, by which he has reduced the consumption of coals from eleven tons to four and a half tons per week, and supplies the town with water in four hours less time each day than was previously required.—*Hampshire Advertiser.*

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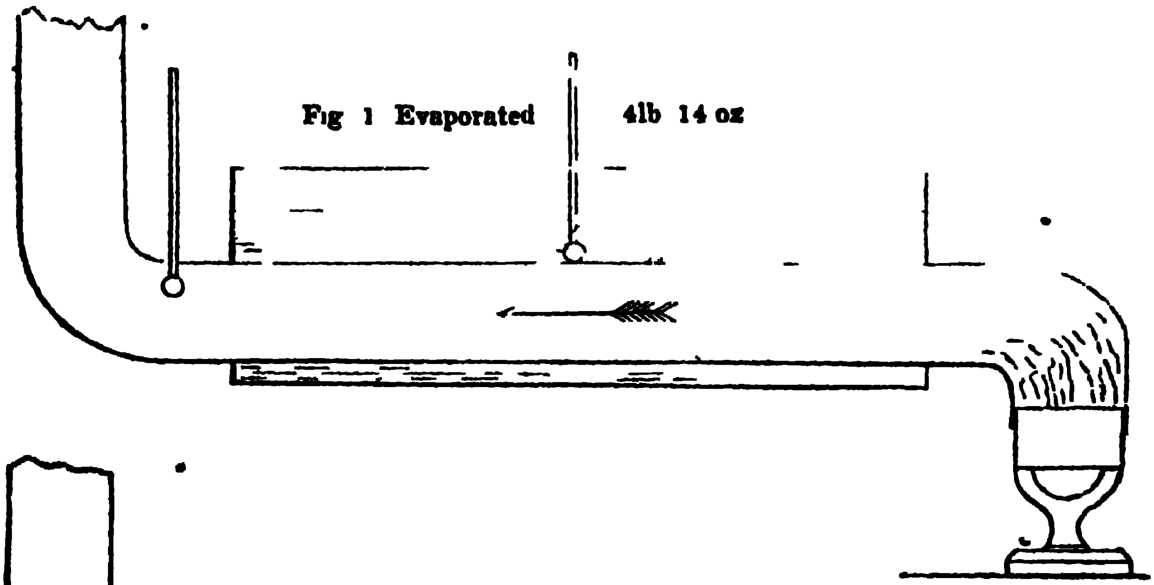
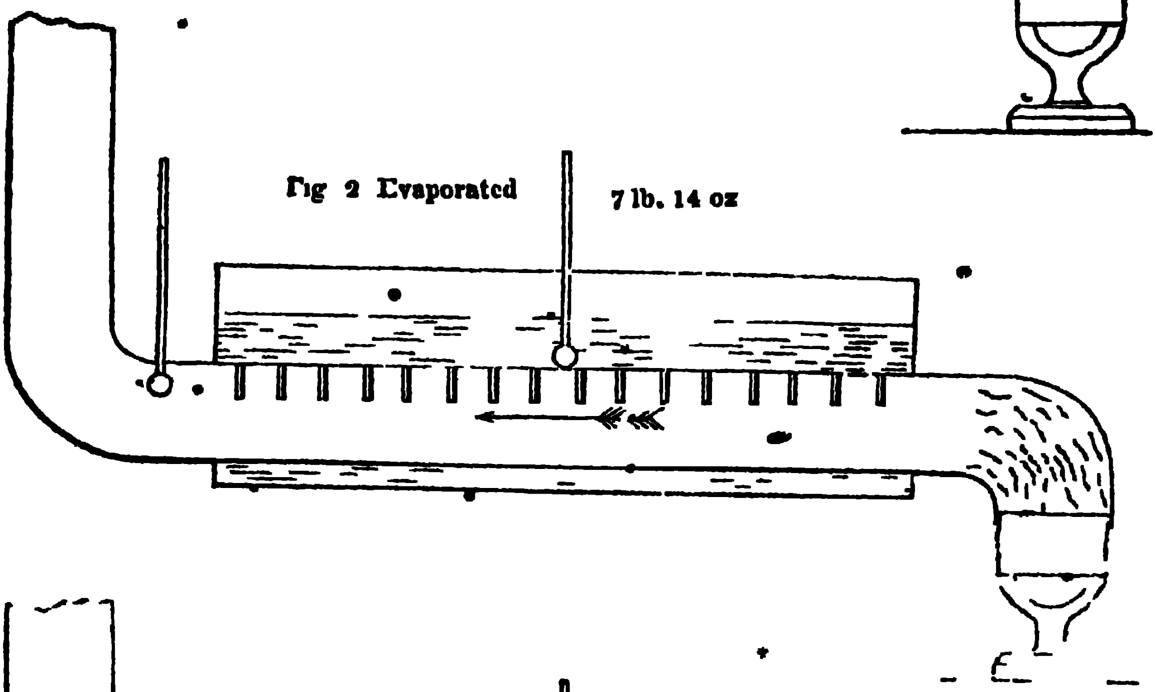
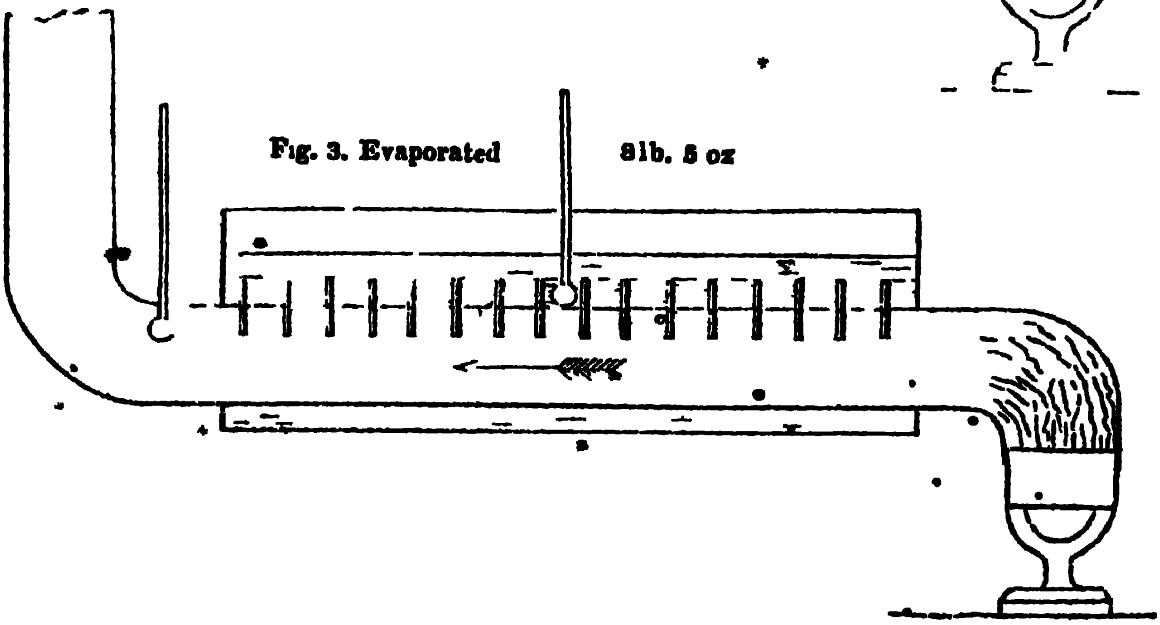
## WILLIAMS'S IMPROVEMENTS IN BOILERS.



## ON THE EVAPORATIVE POWERS OF BOILERS. BY C. W. WILLIAMS, ESQ.

[Abstract of Paper read before the Polytechnic Society of Liverpool, concluded from page 329.]

In each pan was put 22 lbs. of water, the heat being derived from a large laboratory gas burner; 30 cubic feet of gas being consumed in each, in two hours and forty minutes. Fig. 1 is a plain pan, which evaporated 4 lbs. 14 ounces of water. Fig. 2, a pan with single conductors, that is, projecting into the flue alone; this evaporated 7 lbs. 14 ounces. Fig. 3, is a pan with double conductors, that is, projecting both in the flue downwards, and in the water upwards, which evaporated 8 lbs. 5 oz. of water. The result is very remarkable, proving the value of increasing the evaporative power of any given surface, rather than increasing the surface itself. Here the quantity of gas consumed was the same: the heat generated was the same: the superficial area of the flue-plate was the same: the only difference being the introduction of the conductors, by the influence of which a greater quantity of the heat generated, and carried through the flue, was conducted to the water, and absorbed by it.

These proofs of the practicability of increasing the evaporative power of any given surface of boiler, show how idle it is to calculate on the practical value of any kind of boiler, by reference to the mere size or surface of the furnaces or flues. The following details of the experiments with the abovementioned three boilers, present some remarkable features in the carrying and conducting powers brought into action. The heat of the water, and that escaping by the funnel, were indicated by two thermometers placed in each; and thus we are shown, that where the lost heat is greatest, the evaporative power is necessarily the least—proving the importance of attending to the temperature of the escaping gases in all evaporative experiments.

Fig. 1.

*Pans without Conductors.*

| Gas consumed. | Heat of water. | Heat escaping. |
|---|---|---|
| | 58 | 62 |
| 5 feet | 120 | 382 |
| 10 | 152 | 390 |
| 15 | 162 | 395 |
| 20 | 164 | 396 |
| 25 | 166 | 402 |
| 30 | 166 | 406 |

Evaporated 4 lbs. 14 ounces.

Fig. 2.

*Pan with single Conductors.*

| Gas consumed. | Heat of water. | Heat escaping. |
|---|---|---|
| | 58 | 62 |
| 5 feet | 143 | 257 |
| 10 | 160 | 280 |
| 15 | 172 | 385 |
| 20 | 178 | 392 |
| 25 | 186 | 300 |
| 30 | 188 | 320 |

Evaporated 7 lbs. 13 ounces.

Fig. 3.

*Pan with double Conductors.*

| Gas consumed. | Heat of water. | Heat escaping. |
|---|---|---|
| | 58 | 62 |
| 5 feet | 152 | 248 |
| 10 | 174 | 273 |
| 15 | 178 | 276 |
| 20 | 182 | 278 |
| 25 | 186 | 282 |
| 30 | 188 | 284 |

Evaporated 8 lbs. 5 ounces.

The conclusion to which we arrive, necessarily is, that, unless the carrying power of the gases from combustion, and the conducting power of the flue plates are not in harmonious adjustment; that is, are commensurate in their effect, and correspond in point of time, distance, and surface, the entire of the available power of the combustibles employed cannot be obtained.

Mr. Durance, the able engineer of the Manchester and Liverpool Railroad, here observed, that he had made a partial application of the principle in one of the stationary boilers which had hitherto been deficient of steam, and that the result was both remarkable and satisfactory. He had introduced but 105 conductor pins, and the effect was, the giving him a full command of steam.

Mr. Williams further stated, that he had applied the principle to the boilers of a 6-horse engine, and the result was, that each inch deep of water, which before required 28 minutes to evaporate, was now done in 20 minutes, being an increase in evaporative power of 28 per cent.

He also exhibited several iron pins which had been exposed to the greatest heat, being inserted in the bottom of the above boiler, but there was no perceptible action or deterioration. He came therefore to the conclusion, that conductors projecting internally into

the flues about 3 inches, is the most convenient and practicable length.

With respect to the projection into the water, this will depend on convenience: but, although a length of 2 or 3 inches afforded extremely favourable results, still the advantage was very great, even when there was no inside projection whatever, as in the pan, fig. 2. This arrangement, as it is most advisable, where any internal incrustation or crystallization might take place, as in salt evaporative pans, he strongly recommended.

These considerations lead to an important modification in the construction of boilers, by rendering the sides, or vertical surfaces, equal to that of the upper, or horizontal, surfaces. They also establish the value of increasing the evaporate power of given areas of boiler plate, rather than enlarging those areas by extending the flues; the effect being to enable a small boiler to give as great an evaporative power as a larger one.

## ON AN UNIFORM SYSTEM OF SCREW THREADS — COMMUNICATED TO THE INSTITUTION OF CIVIL ENGINEERS, 1841. BY JOSEPH WHITWORTH, ESQ. ASSOC. INST. C. E.

The screw threads which form the subject of this paper, are those of bolts and screws, used in fitting up steam engines and other machinery. Great inconvenience is found to arise from the variety of threads adopted by different manufacturers. The general provision for repairs is rendered at once expensive and imperfect. The difficulty of ascertaining the exact pitch of a particular thread, especially when it is not a submultiple of the common inch measure, occasions extreme embarrassment. This evil would be completely obviated by uniformity of system, the thread becoming constant for a given diameter. The same principle would supersede the costly variety of screwing apparatus, required in many establishments, and remove the confusion and delay occasioned thereby. It would also prevent the waste of bolts and nuts which is now unavoidable. The impulse and direction given to machinery during late years have tended to increase these evils, and must ultimately lead to a change of system. Take for example the refitting shop of a Railway or Steam Packet Company. Here the variety of apparatus rendered necessary by the want of uniformity will correspond with the number of distinct manufacturers by whom the engines are supplied; whereas if the same system of screw threads were common to the different engines, a single set of screwing tackle would suffice. The economy and manifold advantage resulting from uniformity in this instance, must be sufficiently obvious.

Supposing the same principle extended throughout engineering and other establishments until its application became general, the advantage would be proportionally greater, and would assume a character of public importance. Public convenience would be promoted, in various ways, easy to trace though leading to results perhaps little expected, and the economy of screwing apparatus, however considerable, would become insignificant when compared with the contingent benefit to other interests.

Were an uniform system adopted for marine or locomotive engines, there can be no doubt that it would be extended to engines and machinery of almost every description. Peculiar threads will, of course, be always required for particular purposes; but in screws for general use in fitting up machinery, the advantage of uniformity would be paramount to every other consideration.

It does not appear that any combined effort has been hitherto made to attain this object. As yet there is no recognized standard. This will not be matter of surprise, when it is considered that any standard must be to a great extent arbitrary. It is impossible to deduce a *precise* rule from mechanical principles, or from any number of experiments. On the other hand, the nature of the case is such that mere approximation would be unimportant, absolute identity of thread being indispensable.

To how great an extent the choice of thread is arbitrary will appear from a cursory consideration of the principles affecting it. Without attempting to discuss these in detail, which would be foreign to the present purpose, it may

be interesting to notice the general outline and bearings of the subject.

The use of the screw bolt is to unite certain parts of machinery in close and firm contact. It is peculiarly adapted for this purpose by the compact form in which it possesses the necessary strength and mechanical power. The extreme familiarity of the object tends to prevent the observation of its peculiar fitness. Yet among all the applications of mechanics, there is, perhaps, no instance of adaptation more remarkable. The ease with which distinct parts of machinery can be united, the firmness with which they are held together, and the facility with which they may be separated, are conditions of the utmost importance, which by no other contrivance could be combined in an equal degree.

While, however, the utility of the screw in this application is abundantly obvious, it is by no means evident what may be the precise formation most advantageous under all circumstances. No exact data of any kind can be obtained for calculation, and the problem will be found to be capable only of approximate solution.

The principal conditions required in the screw bolt are power, strength, and durability—the latter having reference to the wear occasioned by frequent fixing and unfixing.—But none of these conditions can be reduced to a definite quantity. We cannot, for example, determine the exact amount of power necessary to draw the parts of a machine into due contact, or the precise degree of strength which may suffice for resisting the strains to which they may be afterwards exposed. Hence we cannot lay down any rule for choosing the diameter of the screw bolt required for a given purpose. Practical men can judge of the proper size with considerable nicety, but they have no means of ascertaining it with absolute precision.

If the diameter be given, and it be required to find the proper thread, the nature of the qustion is not essentially altered. The amount neither of power, nor of strength, (nor any other condition,) is thereby determined. A certain limit is assigned, but within that limit the proportions of strength and power, etc., may vary indefinitely according to the actual formation of the thread.

There are three essential characters belonging to the screw thread, viz., pitch, depth, and form. Each of these may be indefinitely modified independently of the others, and any change will more or less affect the several conditions of power, strength, and durability. The mechanical power of the screw depends on the pitch, which for a given diameter determines the angle of the inclined plane, and on the form of thread which regulates the direction in which the force applied will act. The strength of the screw in the thread varies with each of the three characters; in the centre part, being as the area, it is little affected, except by change of depth. The durability of the thread also depends chiefly on its depth, and the proper degree of the latter is determined principally with reference to this condition. In the selection of the thread considerable latitude of choice will be found to prevail with reference to all the characters. No definite rule can be given for determining any one of them. It may be manifest that particular threads are too coarse or too fine, too deep or too shallow; but there are intermediate degrees within which the choice of thread, like that of the diameter, is arbitrary, and must be guided rather by discretion than by calculation.

The mutual dependence of the several conditions required in the thread may be noticed as having a tendency to perplex the choice. Thus increase of power is necessarily attended with diminution of strength. The square thread, which has the advantage in respect of power, is proportionally weaker than the angular thread. A fine thread loses in strength, while it gains mechanically as compared with a coarser. Deep threads also, while they are more durable than shallow, materially detract from the strength of the bolt.

The selection of the thread is also affected by the mutual relation subsisting between the three constituent characters of pitch, depth, and form. Each of these, as before observed, may be separately modified; but practically no one character can be determined irrespective of the others. The pitch of the square thread is generally twice that of the angular for the same diameter, to retain similar proportions of

power and strength. Coarse threads should be deep as compared with fine, to provide against the wear from friction. A coarse angular thread will also require additional depth to preserve the due proportion of power, and to prevent the longitudinal strain from being thrown too much sideways on the nut. Hence, each character acts as a limit to the variation of the others, and in some instances, (that is in the case of certain diameters,) it will be found that the leading consideration in fixing one character is the resulting effect on another. Thus, in some of the smaller sizes, the pitch is determined principally by reference to the depth—a coarser thread being objectionable, because the extra depth would too much weaken the centre part of the bolt,—while the necessary shallowness of a finer thread would render it too liable to wear with friction.

The proportionate strength of the thread and centre part of the screw is regulated mainly by the depth of the nut, which is generally of the same measure as the diameter of the bolt. Assuming this dimension as fixed, the proportion of strength between the two parts will vary with the different characters of thread, and more particularly with the depth. The centre part not being liable to wear while the thread is subject to friction and accidental injury, the original proportion of strength ought to be considerably in favour of the latter.

Such being the variety and vagueness of the principles involved in the subject, a corresponding latitude might naturally be expected in their practical application, and accordingly we find, instead of that uniformity which is so desirable, a diversity so great as almost to discourage any hope of its removal. The only mode in which this could be attempted with any probability of success would be by a sort of compromise, all parties consenting to adopt a medium for the sake of common advantage. The average pitch and depth of the various threads used by the leading engineers would thus become the common standard, which would not only have the advantage of conciliating general concurrence, but would, in all probability, be nearer the true standard for practical purposes than any other.

Messrs. Whitworth and Co. were led some years ago to alter the threads of their screwing tackle on this principle, in consequence of various objections urged against those they had previously adopted, and the result of the experiment has been abundantly satisfactory. An extensive collection was made of screw-bolts from the principal workshops throughout England, and the average thread was carefully observed for different diameters. The $\frac{1}{4}$, $\frac{1}{2}$, $1\frac{1}{2}$ inches were particularly selected and taken as the fixed points of a scale by which the intermediate sizes were regulated. The only deviation made from the exact average was such as might be necessary to avoid the great inconvenience of small fractional parts in the number of threads to the inch. The scale was afterwards extended to 6 inches.

The pitches thus obtained for angular threads are shown in the following table,

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Diameter in inches. | $\frac{1}{4}$ | $\frac{5}{16}$ | $\frac{3}{8}$ | $\frac{7}{16}$ | $\frac{1}{2}$ | $\frac{5}{8}$ | $\frac{3}{4}$ | $\frac{7}{8}$ | 1 | $1\frac{1}{8}$ | $1\frac{1}{4}$ |
| Threads to the inch. | 20 | 18 | 16 | 14 | 12 | 11 | 10 | 9 | 8 | 7 | 7 |
| Diameter in inches. | $1\frac{3}{8}$ | $1\frac{1}{2}$ | $1\frac{5}{8}$ | $1\frac{3}{4}$ | $1\frac{7}{8}$ | 2 | $2\frac{1}{4}$ | $2\frac{1}{2}$ | $2\frac{3}{4}$ | 3 | $3\frac{1}{4}$ |
| Threads to the inch. | 6 | 6 | 5 | 5 | $4\frac{1}{2}$ | $4\frac{1}{2}$ | 4 | 4 | $3\frac{1}{2}$ | $3\frac{1}{2}$ | $3\frac{1}{4}$ |
| Diameter in inches. | $3\frac{1}{2}$ | $3\frac{3}{4}$ | 4 | $4\frac{1}{4}$ | $4\frac{1}{2}$ | $4\frac{3}{4}$ | 5 | $6\frac{1}{4}$ | $5\frac{1}{2}$ | $5\frac{3}{4}$ | 6 |
| Threads to the inch. | $3\frac{1}{4}$ | 3 | 3 | $2\frac{7}{8}$ | $2\frac{7}{8}$ | $2\frac{3}{4}$ | $2\frac{3}{4}$ | $2\frac{5}{8}$ | $2\frac{5}{8}$ | $2\frac{1}{2}$ | $2\frac{1}{2}$ |

It will be observed that above 1 inch diameter the same pitch is used for two sizes. This could not have been avoided without introducing small fractional

parts. The economy of screwing apparatus was also promoted by repetition of the thread.

It is important to remark that the proportion between the pitch and the diameter varies throughout the entire scale. Thus the pitch of the ¼ inch is one-fifth of the diameter—that of the ½ inch, one-sixth—of the 1 inch, one-eighth—of the 4 inch, one-twelfth—of the 6 inch, one-fifteenth. It is obvious that more power is required as the diameter increases. But this consideration alone will not account for the actual deviation, which is much less than it would be if the scale were calculated with reference to the power required. The amount of power necessary must be determined in relation to the muscular force of the human arm, aided by the leverage of the screw-key. Now in the case of smaller screws, there is a considerable excess of force, and consequently of power. Again, in the larger there will be found a deficiency of power, for with all the leverage which can generally be applied, it requires the force of several men to fix a bolt of 6 inches diameter. Hence it is evident that at the two extremes of the scale, the amount of power required is not the leading consideration in fixing the pitch of the thread. In the smaller sizes the necessary depth of a coarser thread, as before observed, would too much weaken the centre part of the screw. It may also be mentioned that coarse threads would render small screws apt to work loose for want of sufficient hold to prevent the effect of jarring. On the other hand, finer threads on large bolts, besides being weaker and less durable, might render it difficult to unfix them when occasion required.

It will be remembered that the threads of which the preceding table shows the average, are used in cast iron as well as wrought, and this circumstance has no doubt had its effect in rendering them coarser than they would have been, if restricted to wrought iron.

The variation in depth among the different specimens was found to be greater proportionally than in pitch. The angle made by the sides of the thread, will afford a convenient expression for the depth. The mean of the variations of this angle in one-inch screws was found to be about 55°, and this was also pretty nearly the mean of the angle in screws of different diameters. As it is for various reasons desirable that the angle should be constant, more especially with reference to general uniformity of system, the angle of 55° has been latterly adopted throughout the entire scale. A constant proportion is thus established between the depth and the pitch of the thread. In calculating the former, a deduction is to be made for the quantity rounded off, amounting to one-third of the whole depth, that is, one-sixth from the top, and one-sixth from the bottom of the thread. Making this deduction, it will be found that the angle of 55° gives for the actual depth rather more than three-fifths, and less than two-thirds of the pitch. The precaution of rounding off, is adopted to prevent the injury which the thread of the screw, and that of the taps and dies might sustain from accident.

The system of threads selected in the manner above described has already obtained greater extension than any other. It has been adopted exclusively on many of the railways, and in some of the most extensive engineering establishments in England and Scotland. During the present year it has been introduced into the Royal Dock Yard at Woolwich, and it is now being applied to the engines constructing for the Royal Mail Steam Packet Company. There is, therefore, reason to hope it may be instrumental in promoting the proposed object, of which it already exemplifies, on a subordinate scale, the practicability and advantage.

But the difficulty of obtaining a concurrence of opinion in favour of a particular system is not the only one to be encountered. The inconvenience to existing establishments which any change would involve, is calculated to retard the prevalence of an approved system, nor could general co-operation be reasonably expected unless there were a certain prospect of success. This, however, is an obvious reason why the attention of engineers should, without loss of time, be directed to the subject.

It will probably occur to practical men that there are other obstacles to be surmounted before the principle of

uniformity can be carried into full operation. The great want of accuracy in screwing and tapping by the ordinary process, may be particularly mentioned. To whatever extent this may prove an obstruction, it may be also regarded as an additional motive for urging the subject on general attention. The necessity for greater correctness will thus be placed in a new and stronger light, and the effect, no doubt, will be a material improvement in this essential respect. It is mainly for want of accuracy that screw-bolts so frequently fail. Unless the threads of the screw and nut exactly correspond in every part, and coalesce throughout their whole length and depth, their mutual action is completely deranged, power and strength are both sacrificed, and friction is proportionally increased. The immense consumption of bolts and nuts in fitting up and working machinery may give some idea of the extent to which greater accuracy might be productive of economy.

It is intended on a future occasion to enter more particularly into the subject of screwing tackle, when it will appear that there are ample means for attaining the requisite degree of accuracy in ordinary practice.

To maintain uniformity, provision must be made for multiplying standards of the diameters and threads. Without a particular provision of this kind, which, as will be shown hereafter, may be easily made, the screwing tackle would degenerate by use and propagation.

This part of the case is connected with a subject of great extent, which, under every aspect, lays claim to the attention of practical engineers. We allude to the general use of standard gauges, graduated to a fixed scale, as constant measures of size. It is quite practicable by such means to work to a common measure with a degree of accuracy sufficient for all ordinary purposes. Corresponding parts, instead of being got up one to another, might be prepared separately. The indefinite multiplication of sizes would thus be prevented, and the economy of the workshop simplified to an extent beyond calculation.

J. W.

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On the reading of this paper at the Institution of Civil Engineers (15th of June last) Mr. Field claimed for the late Mr. Maudslay the credit of having been the first to urge the adoption of an uniform system of screw threads, as well as of having contributed more than perhaps any other individual to the excellence to which we have obtained in this branch of machinery. The President, Mr. Walker, and Mr. S. Seaward corroborated the statements of Mr. Field. All parties, however, concurred in awarding great praise to Mr. Whitworth for the talent and energy with which he has revived the subject, and in earnestly hoping that his endeavours may be attended with the success which they so eminently deserve. We quite agree with Mr. W. in thinking that were the same uniformity which he contends for in the case of screws, extended to other articles which are common to a great number of different machines—were a set of standard gauges brought into general use, instead of sizes and varieties being multiplied without end—"the economy of the workshop would be simplified to an extent beyond calculation;" not only so, but the cost of machinery of every sort greatly diminished.

## THE MAGNETIC NEEDLE CONSIDERED IN RELATION TO THE NEW THEORY OF THE UNIVERSE—(VOL. XXXII, P. 555.)

Sir,—The magnetic needle having engaged the attention of intellects in every respect so much superior to mine, I should scruple to offer to the public any observations on the subject, were it not that I consider myself as standing on different ground than that from which it has been hitherto viewed, and, once for all, I wish it to be understood, that when I aver that such or such things are, I only intend to say such or such things would be in accordance with my theory.

The magnetic, or *loaded* needle (for, if I have rightly informed myself, the needle, before and after being magnetized, has not the same centre of gravity,) is, principally, under the influence of six forces, which act at right angles, and also in opposition, namely, north and south (from heat and cold) east and west, (from the motion of the earth,)

*up* and *down* (from absorption and exhalation). It would be useless to attempt to point out the innumerable instances in which these forces must sustain alterations. That they are of the most delicate nature, we must conclude, since with every possible care of the nicest observer, differences of variation occur, at the same time, when experiments are made in a house and in the open air. Traversing fluids partaking of the nature of the principal currents passing in *every* direction, must necessarily tend to promote alterations *in every* direction, to say nothing of the effect of the variations of land, water, &c. on the earth's surface.

I am no chemist; but may I ask, if there would be any thing absurd in calling electricity metallized heat, and the magnetic fluid in particular, ironized heat?

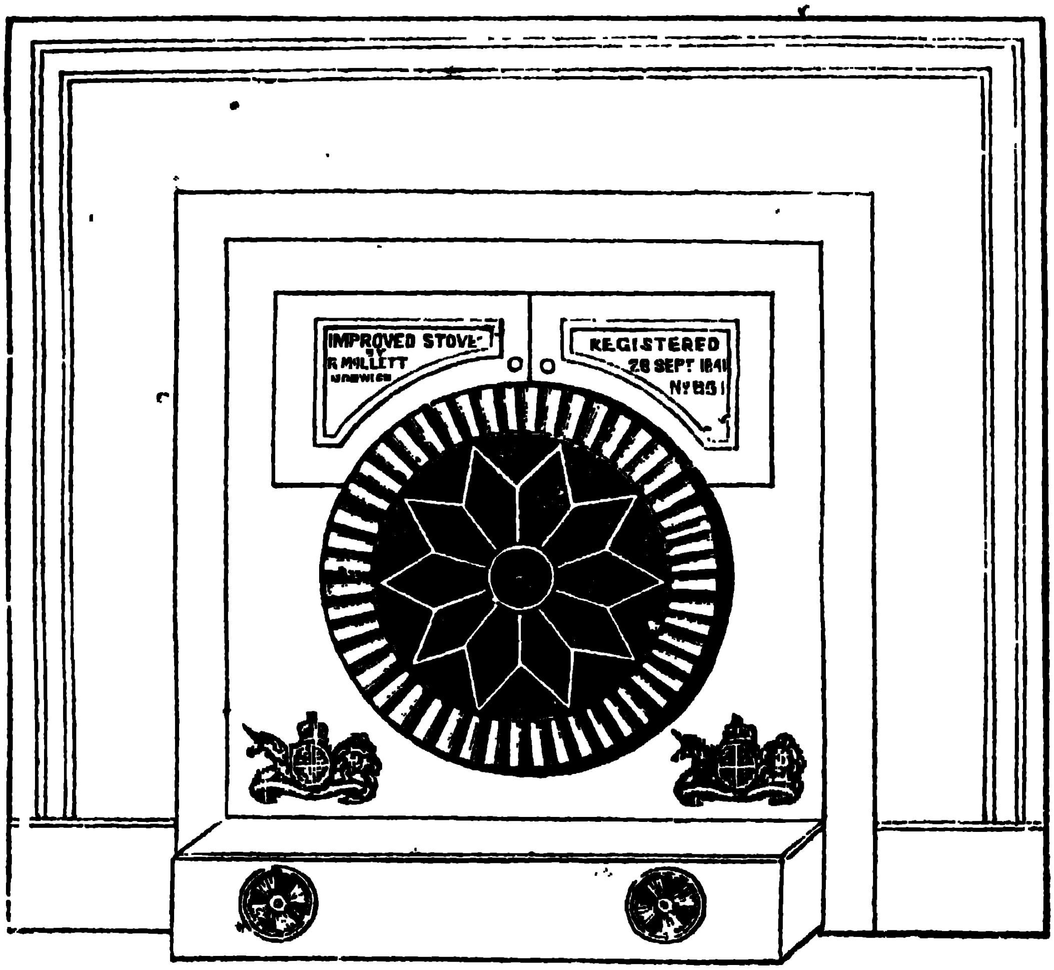
I am, your obliged obedient servant,

E. A. M.

October 9, 1841.

## MOLLETT'S SOLAR STOVE.

(Registered pursuant to Act of Parliament.)*




The new stove represented in the above engraving, the invention of Mr. Mollett, of Norwich, is decidedly novel in appearance and construction. The fire place, which is of a circular form, is surrounded by a bright reeded circle, and from its producing an effect resembling the sun's rays, the stove has been called the "solar stove." Above the fire place there are two doors, for the purpose of regulating the draught; when the doors are set open the draught is diminished, but by closing them it may be increased to any required extent. Either coke or coals may be used as fuel in these stoves, and should the fire become low, and the apartment cold, by adding a fresh supply of fuel, and closing the upper doors, the room will be very quickly heated to the desired degree.

An ash-pan or drawer, below the

fire-place, receives the dust and cinders, and also the contents of the grate, when it is desired to extinguish the fire, which, on pressing a lever at the back of the right hand door, falls directly into the box, thereby avoiding—what has been asserted to be the cause of many serious conflagrations--poking out the fire at bed-time.

This stove is an effectual cure for smoky chimneys, as it admits of an easy adaptation to the circumstances of every situation; it is furnished with an extra flue at the back to carry off all the foul or burnt air, as well as any dust that may be created by stirring the fire.

The inventor states that he has had one of these stoves in use for some time, and that it fully answers, in every respect, his most sanguine expectations.

Our Norwich friends may, however, judge for themselves, as one of the stoves is to be seen in use at Mr. Mollett's warehouse, Cowgate Street, Magdalen Street, Norwich.

### MR. OXLEY'S PLAN OF STEAM NAVIGATION—FATE OF INVENTORS.

> "One intellect not all things comprehends;
> The genius formed for weeds, and grubs, and flies,
> Can't have for ever at its finger ends
> What's doing every moment in the skies."
>
> PINDAR.

SIR,—I have read, over and over again, and each time with additional interest, the "new contribution to the history of the steam engine," published in your 937th number, and I cannot help thinking that the writer, Mr. Oxley, has done well to place the matter on record in the time-enduring pages of your "Journal."

His narrative, indeed, affords a lamentable but faithful picture of what the "patrons of science" were half a century since, with their limited perceptions and aristocratic prejudices.

It is true, as Mr. Oxley pertinently observes, there were no "Mechanics' Magazines" in those days, to assist inventive genius by the free interchange of thought; nor had the science of constructive engineering so far developed its powers, as to give any promise of its now gigantic progress.

There were still, however, materials enough forthcoming, had there existed any disposition to seek them, to have enabled an impartial and unprejudiced mind to form a very different opinion of Mr. Oxley's proposed scheme, from that entertained by (thanks to Peter Pindar) the immortal Sir Joseph Banks. At the time when Mr. Oxley submitted his plan to this President of the Royal Society, the capabilities of steam in the production of power, even upon a large scale, had become tolerably familiar to the well informed; and Mr. Oxley was convinced "that an agent so immensely powerful as the steam engine, might be successfully employed for many useful purposes, besides *rolling* and *slitting* of metal, and *pumping water* out of mines."

To the capabilities of steam, as a source of power, Sir Joseph Banks seems to have urged no objection, but confined himself to two points—the impossibility of giving sufficient steadiness to the machinery, and sufficient strength to the revolving oars. The first point is one, upon which a shipwright of the lowest class could at once have put him right; the second objection might have been negatived by reference to the successful performances of the ancients, as well as by the then practice of the Americans. For we are told, upon the authority of Vitruvius, that "the ancients had a way to drive their ships without oar or sayl, so that they could never be windbound; they had in their ships three wheels on each side, with eight radii of a span long, jutting out from every wheel; six oxen within did turn this machine and wheels, which casting the water backward, did move the ship with incredible speed and force." And boats similarly propelled were employed in America, about the very time at which the correspondence referred to was in progress.

Indisposition honestly to investigate any plan that seems to militate against preconceived notions, on the part of those in whose power it lies to foster and encourage latent talent, and the incapability of struggling genius to bear up against the barriers raised in their progress by such feelings, has perpetuated the reign of the "dark ages" to an extent that can never be fully known.]

Until the present year, I dare say

many of your intelligent readers knew but imperfectly, or not at all, to whom they were actually indebted for the invention of steam navigation; although the claims of Symington are now established upon a basis, which time can only make more sure.

Most nobly have you secured for his memory that renown, and you will yet, I trust, obtain for his family that reward, which was not only denied to him in his life time, but would even now be wrested from him and appropriated where not a shadow of a just claim exists.

May every ill-used son of genius find an equally powerful advocate against all such envious minds as would withhold the acknowledgments due to merit, and rob it of its just reward.

It is a lamentable, though undeniable fact, that of all classes of men in this country, inventors have ever been, and still are, both *legally* and *socially*, the most oppressed.

I am, Sir, Yours, &c.

W. BADDELEY.

London, September 30th, 1841.

THE GENERAL STEAM CARRIAGE COMPANY—MR. BEALE IN REPLY TO COL. MACERONE.

SIR,—The statement of Col. Macerone in your Magazine for the 23rd inst. is erroneous. My first bill was 1102*l.*, and my subsequent one for alterations, &c., and running some hundreds of miles, 290*l.* I believe that Col. Macerone has done more than any other man in the kingdom towards steam locomotion on common roads, and that if his scheme were properly supported it would succeed, and be of vast utility to the community.—By giving the above statement a place in your valuable Magazine for Saturday next, you will confer a favour on

Your obedient Servant,

J. T. BEALE.

East Greenwich Steam Engine and Iron Works, 25th Oct., 1841.

DR. ROTH'S CALCULATING MACHINE.

Since the brief notice which we gave last week of this machine, on the authority of the *Times*, we have ourselves had an opportunity of personally witnessing its performances, at the Polytechnic Institution, and cordially bear our humble testimony to the great efficiency (within certain limits) of the invention. We use the word *machine*, as the whole of Dr. Roth's calculating contrivances may, we understand, be combined in one frame or case; but what we saw were *two* separate machines or instruments—one for performing the operations of addition and subtraction, which is of a rectangular form, about 6 inches long by 3 in breadth; and the other for doing sums in multiplication and division, which is of a circular form, about 12 inches in diameter, and 3 inches in thickness. On the face of each machine there is a series of revolving circles or zones, each bearing the integral numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, and each representing either units, or tens, or hundreds, or thousands, &c. Beneath each figure there is an orifice, by inserting a small hand-style or pricker, in which the circle to which it belongs can be turned round, so as to present that figure to any point of the circle desired. All these circles are connected with and act upon a system of wheel work concealed from view beneath the face of the machine, (like the machinery of a watch,) but in what manner or on what principle is not explained, and will probably remain a secret till the specification of the patentee (Mr. Wertheimer) is enrolled. As the numbers to be added, subtracted, multiplied, or divided, are given to the operator, he transfers them to the machine by means of the style; and when the whole are told off, you see almost at the same instant the product or answer to the question, exhibited to view through a series of open circular spaces left in the face of the machine, immediately above the revolving circles. We saw a great many questions solved by these machines, in each of the first four rules of arithmetic, as fast as they could be enunciated, and in every instance without the slightest error. Whether the system of the inventor can be made applicable to the solution of questions in the higher branches of the science of numbers, remains yet to be seen; but we have no doubt on our minds of

its complete mastery over all the more ordinary computations required in the current business of life. Dr. Roth's machines have the defect, which is probably inseparable from all machines of this class, that you cannot retrace the steps of any computation made by them; so that if any error is made in the delivery of a series of numbers to the machine, and which of necessity will produce an erroneous product, it is impossible to detect where that error lies, and your only remedy is to perform the whole computation over again. But it is to be observed, on the other hand, that so rapid is the operation of these machines, that you may make any computation by them (within the range of common arithmetic) half a dozen times over, in the same time that it would take most persons to make the same computation by pen or pencil. If used as tests merely by which to check calculations on paper, they must be of immense service in all public offices, banking and commercial establishments, schools, &c. If the numbers are but given to them correctly, the answers furnished by them are *certain to be correct*. One great recommendation which Dr. Roth's machines possess over all others of the sort which we have seen or heard of, is their conveniently portable size, and (should the demand for them be extensive) consequent cheapness. The price now asked for an adding and subtracting machine, of the dimensions before given, is 2*l.* 2*s.*, and for the multiplying and dividing one, 26*l.* 5*s.*; but unless there is something of a more nice and complex character in the concealed machinery, than we have any reason to suppose there is, both machines might be supplied, *in large numbers*, for a fourth of the money, and yield a handsome profit. At the head of the list of subscribers for a set of the machines, we were pleased to observe the names of "Victoria" and "Albert."

PREVENTING ACCIDENTS ON RAILWAYS.

Sir,—Since my last letter to you on the subject of a plan to separate the engine on railroads from the train, in case of its swerving from the rail, another contrivance has suggested itself to my mind, which may perhaps be an improvement. It is this, to drop a circular bolt connected by a bar with the engine, into a cavity made to receive it, which is square at the sides, and strongly affixed to the carriage train, which strong bolt or key will, on the engine deviating from the right line, be gradually lifted from its socket by a sloping shoulder on either, that is united with the attachment to the train, whether the engine swerve to the right or to the left, and thus the pin or bolt, having lost its hold, will be separated from the train.

I remain, Sir, Yours, &c.

George Cumberland.

CLYDE STEAMERS.

Sir,—In your valuable Magazine I have seen several notices, taken by A. M., of the *Wallace* and *Burns* Clyde built vessels; but no one, I think, has given A. M. a correct account of the performances of each of these vessels. I would first advert to the notice taken of the run which the *Wallace* had with the *Duchess of Kent*, a vessel belonging to the same Company. The *Wallace* had altogether 30 tons of coal on board, (10 tons in the after-hold, and the rest in the coal bunkers,) and about 40 persons, including the crew. The two vessels started from Blackwall, (not Deptford, as stated by L. P.) and the *Wallace* kept a-head for about half way to Gravesend, when the *Wallace* slacked her speed, to allow the *Duchess* to pass, as the Directors (of the Company) were quite satisfied that the *Wallace* went as fast as she was represented to do. The reason the *Wallace* had so many coals on board, was to place both vessels, as nigh as could be done, with the same weight, so as to give the *Duchess of Kent* a fair chance, and not, as L. P. states, to trim the *Wallace*, which would have done better without any such weight, as she has got too many floats on the water when she is light, (that is, with about 6 tons of coal.) The *Duchess* had, I am informed, only 7 tons of coal, besides her passengers.—With regard to the *Duke of Sussex* beating the *Wallace* 7 minutes, L. P. has been misinformed, as the difference of time was only 5 minutes, which was owing to the *Wallace* having to ease several times to make way for sailing vessels. The *Duke of Sussex* and *Duchess of Kent* I consider as both very fast vessels, and till this summer they had very few superiors.

Nothing has been said about the *Burns*, except by Mr. Bayley, and he states that she was passed by the slowest Gravesend boats. Now, I have made a few inquiries, and I find she is by no means so slow. If she were as Mr. B. represents, how comes it that she has beat every boat she has come along-

side of at Southampton; and some of the boats she has tried and beat, are considered crack boats. The *Burns* has made the quickest passage from Southampton to Torquay and Plymouth, that ever has been done, I believe, by steam. The passage from Southampton to Torquay was done in 10 hours, and from Torquay to Plymouth in 4 hours and ½, without canvass.

I remain, Sir, yours, &c.,

VULCAN.

October 5th, 1841.

THE "BLACKWALL" STEAMER.

SIR,—Your correspondent "Mechanic," wishes to know the cause of the mystery observed by the engineers of *The Blackwall*. Allow me to inform him that the engineers and stokers have orders from their superiors not to inform the *inquisitive public* concerning the pressure of steam in *their* boilers, as many false reports have gone abroad with regard to the pressure used in other steamboats, and which reports have had most injurious effects. With regard to the jerks felt by him upon the admission of steam (worked at too high a pressure) above and below the piston, at the moment of the crank passing each centre, I beg to observe, that engines are worked at a much higher pressure than *The Blackwall*, without the slightest jerk being felt. How then can he account for the shocks or jerks being caused by the admission of the steam, or by the vacuum on the opposite side of the piston? When he is further informed that the slides have what is termed a lead or advance on the engine, to which they admit steam, and that the steam has entered the cylinder previous to the crank having passed the centres, and that in high pressure engines (locomotives, for instance,) the slides have a considerable lead on the piston or stroke of the engine, he will perceive that no other cause can be assigned for the shocks felt, than by the reversing of the momentum given to the beam and other connecting rods of the engine; for instance, the engines of *The Gorgon* (a description of which is given in your instructive Magazine, No. 911,) do not cause such a vibration as engines of the common and steeple construction, where more unequal and heavier connections are used.

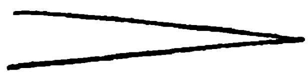
I am, Sir, Yours, &c.,

DICQUE.

October 19.

THE IMPROVED CARPENTER'S BENCH—MR. FIELD IN EXPLANATION.

SIR,—Having been applied to, both personally and by letter, for a better explanation to my plans of "An Improved Carpenter's Bench," and "Improved Shifting Quadrant Mitre Board," as laid down in your Magazine of March 27, 1841, vol. xxxiv., No. 920, I beg leave to correct the following errors of the press. At page 244, 2nd col., line 27, for "the holes B and C, and the clamps. At the head of the bench," read "at the holes B and C, and the clamp at the head of the bench, are stout," &c. Page 245, 1st col., line 2, for "inserted into the board. A, the top screw," read, "inserted into the board A; the top screw, &c." Page 243, for "N N" read "D D D," and in that of "D D" place "N N." Insert the letter *g* as omitted at the stop of the chop C of plate, page 243, as described at page 242, 2nd col., 4th line from bottom. In the end, section S, plate the 1st, the letter "M" is reversed (S being the top of the section). The screw L should have accompanied the engraving H, plate 2. Over fig. H is omitted the line thus



as showing the manner of its opening, as referred to in the reference, page 244, 1st col.

The engraving at the head of plate 1, page 241, as described in the last paragraph of page 244, should have followed that of the bench, and been headed as a separate article, viz. "Field's Improved Quadrant Mitre Board," (this article being entirely distinct from that of the bench.)

I remain, Sir, Yours, &c.,

S. H. FIELD.

Evesham, Mechanics' Institution, 20th Oct., 1841.

ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

*** *Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for that purpose.*

CHRISTOPHER EDWARD DAMPIER, OF WARE, HERTFORDSHIRE, GENTLEMAN, *for improvements in weighing machines.*—Enrolment Office, October 15, 1841.

The first of these improvements consists in the application to weighing machines of a spiral spring, the inner end of which is fixed to the frame, while its outer end is fastened to a pulley, over which a cord passes, and supports the scale-pan. An index, or hand, is attached to the axis of the pulley, which traversing before a graduated scale, indicates the weight of the article placed in the scale. In another arrangement, the inner end of the spring is affixed to the axis of the

pulley, and its outer end fastened to the frame of the machine.

In a second improvement, the graduated scale on the dial of the weighing machine is in a spiral line, and in order that the index may follow the same, a ribbed spiral is cast on the face of the dial, and the index passed through a circular rib, or hoop, projecting from the axis of the pulley behind the dial, the index sliding freely through the hoop. The index is equipped with two anti-friction rollers, and as it turns round, it is moved gradually in or out, so as to correspond with the spiral graduations on the dial.

A third improvement consists in placing a diagonally-cut toothed pinion on the axis of the index, in which a multiplying wheel on the centre of the scale-beam of a weighing machine works, so that a small motion of the scale-beam causes an increased range of the index.

A fourth improvement consists of various modifications of movable bearings for weighing machines; one of them, applied to the scale-beam of a weighing machine, is as follows. A circular aperture is cut in one end of the beam, in which a wheel moves freely, having a segment removed from its upper part, in which the knife-edged axis of a scale-link rests. At the other end of the beam, a similar aperture is made, and a wheel turns freely, through the centre of which the scale-link passes, thereby superseding the knife-edged axis. The ends of the scale-beam axis are knife-edged, and work in suitable bearings; the middle of it is circular, and turns loosely in a circular aperture in the centre of the scale-beam.

A fifth improvement consists in the application of adjusting screws to scale-beams. An adjusting balance-weight is placed at each end of the beam, by screwing of which in or out, the beam is accurately balanced, the points of suspension of the scale always remaining equidistant from the centre of the beam. The end screw is also used to adjust the proportionate distances between the bearings of lever-beams, by using the periphery of the screw-head for one of the knife-edged bearings.

The claim is, 1. To the application of a spiral spring to weighing machines.

2. To the application of a spiral line of graduation, and corresponding movement of the index to weighing machines.

3. To the application of diagonally-cut toothed multiplying wheels to the axis of the index of weighing machines.

4. To the movable bearings and arrangement of knife-edged fulcra connected with the same, as applied to weighing machines.

5. To the adjusting screws, as applied to scale-beams.

Frank Hills, and George Hills, of Deptford, Kent, Manufacturing Chemists, *for certain improvements in the manufacture of sulphuric acid, and carbonate of soda.*—Enrolment Office, October 15, 1841.

The first improvement relates to furnaces or ovens for roasting or calcining pyrites, mundic, or sulphate of iron. The front of the furnace is occupied by a transverse flue, communicating with the ignited fuel of a coke oven, or other large fire. Three ranges of flues branch out from the former, and after one or more turnings, terminate in a chimney flue at the back of the furnace. Between each turn of the flues, the spaces are divided by walls into chambers, in which the pyrites, &c., are burned; these chambers have sliding doors at one end for the admission of air to the burning pyrites, in the proportion required to form sulphurous acid gas. The opposite ends of the chambers communicate through two flues with a condensing chamber. An iron vessel, containing a sufficient quantity of nitre to convert the sulphurous into sulphuric acid, is placed in the latter flue.

A second improvement consists in manufacturing sulphuric acid from the residuum of pyrites that has been burnt in the ordinary way of making that acid. In the present process, the residuum is ground to a powder, and burned in thin strata in any suitable furnace, preference being given to that above described. All the sulphur is thus driven off, and converted into sulphuric acid gas, which being mixed with nitrous acid gas in its passage, is received in the condenser as sulphuric acid.

A third improvement consists in making sulphuric acid from a liquid or hydro-sulphuret of lime; the hydro-sulphuret being put into close iron vessels, the sulphuretted hydrogen is driven off, and after passing through a refrigerating apparatus, is led through a platina pipe kept red hot in a furnace, where it is inflamed; the results of its decomposition—sulphurous acid gas and the vapour of water—are then received in a leaden condenser, and being treated with nitrous acid gas form sulphuric acid.

A fourth improvement consists in obtaining carbonate of soda from the decomposition of sulphate of soda by barytes. A quantity of precipitated carbonate of barytes is mixed with about one-third its weight of tar, or other carbonaceous matter, and made into bricks, which are burned in a kiln resembling a lime-kiln. The caustic barytes thus formed is dissolved in water, and added to sulphate of soda in solution, in the proportion of 78 parts of (dry) barytes, to 72 parts of (dry) sulphate of soda, when decomposition will take place, forming caustic

soda and sulphate of barytes. The soda is afterwards converted into carbonate by the ordinary process.

HENRY AUGUSTUS WELLS, OF ST. JOHN'S WOOD, GENTLEMAN, *for certain improvements in the manufacture of woollen cloth.* Petty Bag Office, October 17, 1841.

The first of these improvements consists in an arrangement of machinery and processes for felting bats of wool for the manufacture of cloth. The bat is wound upon a roller at one end of the hardening machine with a roll of canvass under it; the ends of the bat and canvass are introduced by a revolving apron between two platens, the uppermost of which is solid and movable, while the lower, which is hollow, remains stationary. When the ends of the two rolls have reached the farther end of the machine, the apron is stopped, and steam is admitted beneath the perforated surface of the lower platen. The upper platen, which is weighted, is then caused to traverse backward and forward over the bat, and by its friction, aided by the moist heat, combines the fibres of the wool closely with each other. After a short time the steam is admitted to the lower chamber of the under platen, which dries and causes an additional shrinking of the bat. That portion of the bat is then removed, and a fresh surface brought between the platens, and so on, until the whole of the bat has been operated upon; the portion that has been operated on being wound, with the canvass, upon a roller. The bat and canvass are afterwards tied in another canvass and boiled in soap and water; they are then placed in a suitable trough, and the liquid squeezed out. The bat is then placed in the angular drum of a fulling machine to which steam is admitted; this drum is placed in a cylindrical drum, to which a slow revolving, or oscillating motion is given. In about half an hour the bat is taken out and separated from its canvass, moistened with soap and water, rolled up and laid in a milling, or plating machine, several kinds of which are described. In the milling machine the bat is acted upon by hammers and by steam, which give it the necessary firmness and solidity, and it may be afterwards passed through the ordinary fulling stocks, if desired.

A second improvement consits of an overhauling machine, to be used in lieu of manual labour for stretching cloths during the process of milling cloths, made either by weaving, or by the felting process.

A third improvement consists in depositing every alternate sliver of wool from which the bat is made, with its fibres across those of the preceding one; by which means the cloth made from the bats so formed, are equally rigid and strong in every direction.

## THE STEAM FRIGATE "GEYSER."

On Tuesday last, Her Majesty's steam-frigate *Geyser*, 1,060 tons, built at Sheerness from the designs of Sir William Symonds, and fitted by Messrs. Seaward and Capel, left her moorings off Limehouse on an experimental trip down the river. This fine vessel is the fifth of her class fitted with engines upon what is scientifically denominated the Gorgon principle, which was first introduced into the service by Messrs. Seaward. By this peculiar construction of the machinery, a saving in weight of one-fourth, and more than one-third in space, has been effected over the ordinary beam-engines. The engine-room is only 50 feet long, within which, besides her machinery, she can stow 300 tons of fuel, sufficient for 15 days' steaming at full power, and enough almost to carry her to any sea capital of the civilized world. Upon her troop-deck there is accommodation for 300 soldiers, with their officers, baggage and equipments, besides the usual space allotted to her own officers and crew. The general arrangements and construction of the vessel, do great credit to the scientific and practical skill of the Surveyor General of the Navy; the superior style, the economical adaptations, the harmonious, smooth, yet powerful action of the machinery, also entitle Messrs. Seaward to the highest praise. The distance to below Gravesend and back was performed at the rate of 11½ miles an hour, and so complete was the absence of all noise or vibratory motion, most disagreeably felt in other steamers, that a person standing over the engine-room, or at either extremity of the deck, would scarcely have known that she was under weigh. The Messrs. Seaward provided an elegant collation on board to a numerous party of naval officers, engineers, and scientific gentlemen present on the occasion. "Sir William Symonds" was toasted by the Vice President, Mr. S. Seaward, who complimented the Surveyor General, as the first who had introduced into the navy models adapted by their form, beam, and general construction, alike to sail and steam well. Captain Jones gave "the Health of Admiral Sir Robert Stopford," which was drunk enthusiastically, and modestly yet most effectively responded to by Captain Stopford, who took occasion to observe, that in the exploits at Acre, the two steam-frigates fitted by Messrs. Seaward had done the greatest execution.—*Times.*

## LIST OF DESIGNS REGISTERED BETWEEN SEPTEMBER 22ND AND OCTOBER 21ST.

| Date of Registration. 1841. | Number on the Register. | Registered Proprietors' Name | Subject of Design. | Time for which protection is granted. |
|---|---|---|---|---|
| Sept. 22 | 846 | G. and J. Humphries | Carpet | 1 years. |
| " | 847 | Thomas Horn | Strap fastening | 3 |
| 23 | 848 | William Ground | Corn riddle | 3 |
| 27 | 849 | J. Ridgway and Co. | Plate | 1 |
| 28 | 850 | J. Biddle and Co. | Lamp | 1 |
| " | 851 | Rising Mollett | Stove | 3 |
| 29 | 852 | J. H. Curtis | Cephaloscope | 1 |
| 1 | 853 | C. Hart | Copying machine | 1 |
| " | 854 | Lawrie and Marner | Carriage | 1 |
| 4 | 855 | William Henry Smith | Fastening for trousers, &c. | 3 |
| " | 856 | J. Rodgers and Sons | Knife | 3 |
| 5 | 857 | S. Acroyd | Stove | 3 |
| " | 858 | Samuel Whitfield | Pulley for window-blinds | 3 |
| " | 859 | Thomas Blyth | Waistband | 1 |
| 7 | 860,1 | Benjamin Walton and Co. | Snuffer-tray | 3 |
| " | 862 | Ditto | Coal vase | 3 |
| " | 863 | John Hands | Curtain band | 3 |
| " | 864 | Charles Cook | Spencer | 1 |
| 8 | 865 | Samuel Acroyd | Stove | 3 |
| " | 866 | James Hall | Fastening for the bottoms of trousers | 3 |
| " | 867 | J. T. and G. Clarke | Carpet | 1 |
| 11 | 868 | Thomas Collins | Penholder | 1 |
| 12 | 869 | Henry Phillips | Button | 3 |
| 13 | 870 | James Yates | Stove | 3 |
| 14 | 871 | Thomas Gross | Meat holder | 3 |
| " | 872 | H. Longden and Son | Scraper | 3 |
| " | 873 | Ditto | Stove | 3 |
| " | 874 | Ditto | Scraper | 3 |
| " | 875 | Ditto | Scraper | 3 |
| " | 876 | Joseph Bentley | Guard and cock for a gun lock | 3 |
| " | 877 | Green and Bentley | Oven | 3 |
| " | 878 | William Bedford | Horse singer | 3 |
| 18. | 879,80 | R. A. Sprigg, and W. Poupard | Anti-friction wheels | 3 |
| " | 881 | The Coalbrook Dale Co. | Stove | 3 |
| " | 882,3 | Barber and Cole | Carpet | 1 |
| 20 | 884 6 | Southwells and Co. | Ditto | 1 |
| " | 887 | William Aston | Button | 1 |
| " | 888 | G. Riddle | Penholder | 3 |
| 21 | 889 | B. Walton and Co. | Gridiron | 3 |
| 22 | 890 | James Richmond | Machine for cutting turnips | 3 |
| 25 | 891 | John Davenport | Graining comb | 3 |
| " | 892 | David Davies | Carriage front | 1 |
| 26 | 893 | R. B. Davies | Coffin furniture | 3 |

## LIST OF ENGLISH PATENTS GRANTED BETWEEN THE 22ND OF SEPTEMBER AND THE 24TH OF OCTOBER, 1841.

Jean Louis Alphonse Petigars, of Brewer-street, Golden-square, gentleman, for improvements in the construction of presses. (Being a communication.) September 24; six months.

Hugh Lee Pattinson, of Bensham Grove, Gateshead, manufacturing chemist, for improvements in the manufacture of white-lead, part of which improvements are applicable to the manufacture of magnesia and its salts. September 24; six months.

Frederick Brown, of Luton, Bedford, ironmonger, for improvements in stoves, or fire-places. September 24; six months.

Theodore Frederick Strong, of Goswell-road engineer, for certain improvements in locks and latches. September 28; six months.

Samuel Stocker, of Barford-street, Islington engineer, and George Stocker, of Birmingham, cock founder, for improvements in machinery and apparatus for raising, forcing, conveying and drawing off liquids. September 28; six months.

John While, of Burton, in the Wolds, Leicester, tanner, for an improved horse-hoe, for use in agricultural pursuits. September 29; four months.

Joseph Miller, of Monastry Cottage, East India Road, engineer, for an improved arrangement and combination of certain parts of steam engines used for steam navigation. September 29; six months.

Edward Welch, of Liverpool, architect, for certain improvements in the construction of bricks. September 30; six months.

William Hirst, and Joseph Weight, of Leeds, clothiers, for certain improvements in the machinery for manufacturing woollen cloth, and cloth made from wool and other materials. October 7; six months.

Thomas Wells Ingram, of Birmingham, manufacturer, for improvements in shears and other apparatus for cutting, cropping, and shearing certain substances, parts of which said invention being a communication from a foreigner residing abroad. October 7; six months.

Joseph Clisild Daniell, of Tiverton Mills, Bath, for improvements in the manufacture of manure, or a composition to be used on land as a manure. October 7; six months.

Mathias Nicholas La Roche Barre, of Saint Martin's Lane, Middlesex, manufacturer of cotton, for an improvement in the manufacture of a fabric applicable to sails and other purposes. October 7; six months.

Marcus Davis, of New Bond street, optician, for improvements in the means of ascertaining the distances vehicles travel. October 7; six months.

Thomas Biggs, of Leicester, merchant, for im-

provements in securing hats, caps, and bonnets, from being lost by the effect of wind or other causes. October 7; six months.

Benjamin Ainsworth, of Birmingham, gent., for improvements in the manufacture of buttons. October 7; six months.

John Jones, of Smethwick, Birmingham, engineer, for certain improvements in steam-engines, and in the modes or methods of obtaining power from the use of steam. October 7; six months.

John Harwood, of Great Portland-street, gentleman, for an improved means of giving expansion to the chest. October 7; six months.

William Newton, of Chancery-lane, civil engineer, for certain improvements in engines to be worked by gas vapour or steam. (Being a communication.) October 11; six months.

Moses Poole, of Lincoln's-inn, gentleman, for improvements in fire arms. (Being a communication. October 14; six months.

Edward Massey, of King-street, Clerkenwell, watchmaker, for improvements in watches. October 14; six months.

Henry Ross, of Leicester, worsted manufacturer, for improvements in combing and drawing wool, and certain description of hair, October 15; six months.

Junius Smith, of Fen-court, Fenchurch-street, gentleman, for improvements in machinery for manufacturing cloths of wool and other fibrous substances. (Being a communication) October 20; six months.

John Bradford Furnival, of Street Ashton, farmer, for improvements in evaporating fluids, applicable to the manufacture of salt, and to other purposes where evaporation of fluids is required. October 20.

Henry Davies, of Birmingham, engineer, for certain improved tools, or apparatus for cutting, or shaping metals and other substances. October 21; six months.

Thomas Jones, of Varteg Forge, near Pontypool, Monmouth, engineer, for improvements in the construction and arrangement of certain parts of marine and stationary steam engines. October 21; six months.

James Whitworth, of Bury, Lancaster, manufacturer, and Hugh Booth, of the same place, machine maker, for certain improvements in looms for weaving. October 21; six months.

Martin John Roberts, of Brynycaeran, Carmarthen, gentleman, and William Brown, of Glasgow, merchant, for improvements in the process of dyeing various matters, whether the raw material of wool, silk, flax, hemp, cotton, or other similar fibrous substances, or the same substances in any stage of manufacture, and in the preparation of pigments or painters colours. October 26; six months.

Thomas Holcroft, of Nassau-street, Middlesex, gent., for an improved portable safety boat or pontoon. October 28; six months.

## LIST OF SCOTCH PATENTS GRANTED BETWEEN THE 22ND OF SEPTEMBER AND THE 22ND OF OCTOBER, 1841.

Thomas Gore, of Manchester, machine maker, for certain improvements in machinery, or apparatus for roving, spinning and doubling cotton, silk, wool, and other fibrous materials. Sealed, September 24.

Thomas Warren, of Montague Terrace, Mile End Road, Middlesex, gentleman, for an improved machine for making screws. September 30.

George England, of Westbury, Wilts, clothier, for improvements in weaving woollens, and other fabrics, and for twisting, spooling, and warping woollen and other fabrics, also for improvements in the manufacture of woollen doe-skins. Sept. 30.

William Church, of Birmingham, gentleman, for certain improvements in hooks and eyes, and in machinery for manufacturing the same. Oct. 4.

Joseph Miller, of Monastry Cottage, East India Road, Middlesex, engineer, for an improved arrangement and combination of certain parts of steam engines, used for steam navigation. Oct. 8.

John Varley, of No. 3, Bayswater Terrace, Bayswater, artist, for an improvement in carriages. October 11.

John Barwise, of Saint Martin's Lane, chronometer maker, and Alexander Bain, of Wigmore-street, mechanist, for improvements in the application of moving power to clocks and time pieces. October 15.

William Craig, engineer, Robert Jarvie, rope maker, and James Jarvie, rope-maker, all of Glasgow, for certain improvements in machinery for preparing and spinning hemp, flax, wool, and other fibrous materials. October 19.

William Edward Newton, of 66, Chancery Lane, civil engineer, for certain improvements in the manufacture of fuel. (Being a communication from abroad.) October 19.

Floride Heindruckx, of Fenchurch-street, London, engineer, for certain improvements in the construction and arrangement of fire places and furnaces, applicable to various useful purposes. October 30.

## LIST OF PATENTS GRANTED FOR IRELAND IN SEPTEMBER, 1841.

J. Rangeley, for improvements in the construction of railways, and in the means of applying power to propelling carriages and machinery.

John Lee, for improvements in the manufacture of chlorine.

M. Poole, for improvements in the manufacture of fabrics, by felting.

W. Palmer, for improvements in the manufacture of candles, and in apparatus for applying light.

Charles Sneath, for certain improvements in machinery for the making or manufacturing of stockings, or other kinds of loop work.

## NOTES AND NOTICES.

*The cast-iron Ornaments of Berlin.*—The raw ore from which they are manufactured does not cost more than 1s. 6d. per cwt., but wrought into ear-rings the value becomes 2,734*l.* 2*s.* 6*d.* per cwt., and made into shirt buttons, about 3,000*l.* per cwt. It would not be easy to point out any other metal in which art can increase the value of the raw material 40,000-fold.

*Spelter, (or Zinc.)*—This metal has doubled its price in less than three years, or nearly so—it then being quoted at £18 per ton, while the present price is £33 to £33 10s. per ton in bond. The home consumption of England has gradually increased, being in 1828, only 250 tons, while, in the two past years, it has exceeded 4,000 tons per annum. The quantity forwarded from Breslau for the past three years, making the statement up to the 31st August, was, in 1839, 13,000 tons; in 1840, 9875 tons; and in 1841, 6,365 tons; so that, whilst the annual consumption of England (as well as that of France, which consumes from 8,000 to 9,000 tons) has increased, the production of the article has been diminished, which is manifest from the fact, that in 1839, when the price was about £19, the quantity forwarded from Breslau was 13,300 tons; in 1840, when the price was about £22, it was 9,900 tons; and this year, the price being £33, the quantity is reduced to 6,400 tons.—*Mining Journal.*

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# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 952.] SATURDAY, NOVEMBER 6, 1841. [Price 3d.

Edited, Printed and Published by J. C. Robertson, No. 166, Fleet-street.


## CAPTAIN TAYLER'S FLOATING BREAKWATER.

Fig. 1.

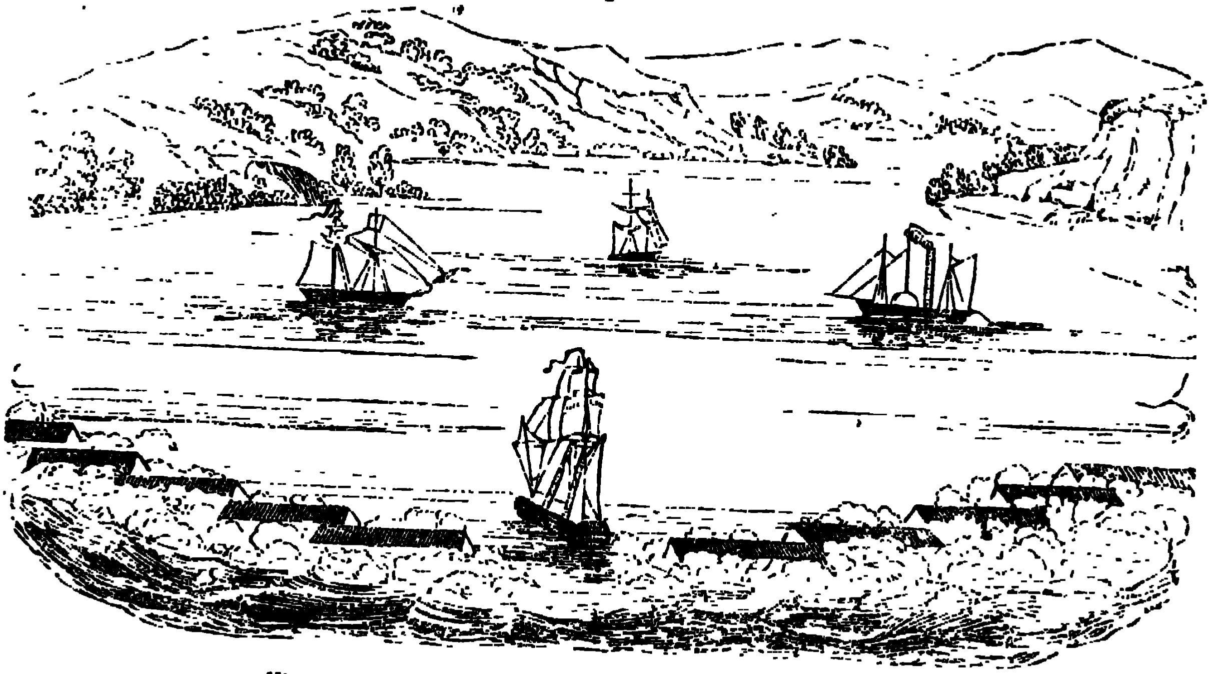


Fig. 2.

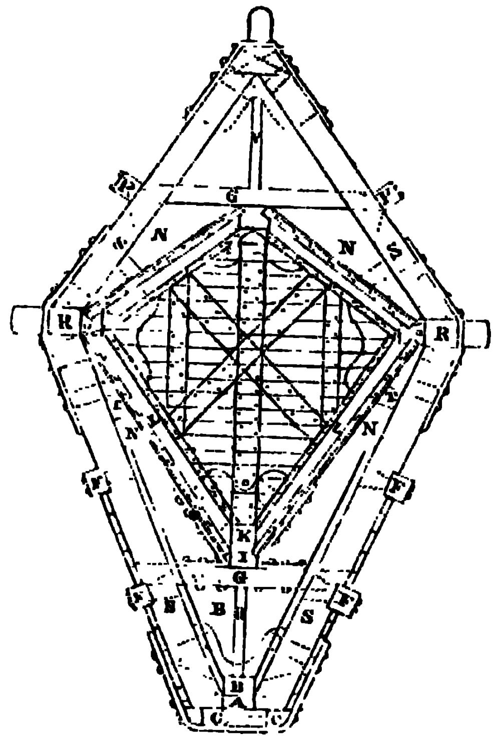


Fig. 3.

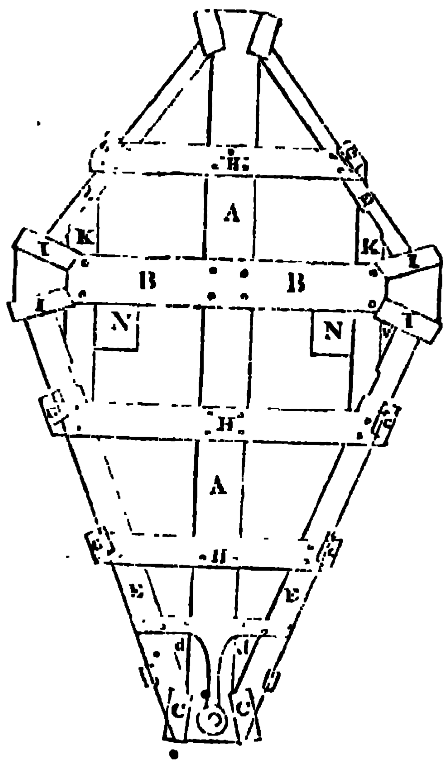


Fig. 4.

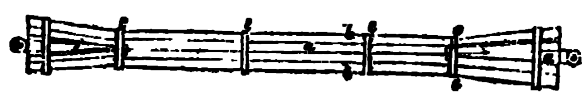


Fig. 5.

## CAPTAIN TAYLER'S FLOATING BREAKWATER.

[Patent dated July 2, 1838; Specification enrolled January 2, 1839.]

The floating breakwater of Captain J. N. Tayler, is presented to the notice of the public, as being superior to all breakwaters hitherto known, in four particulars:—

1. It is constructed of a frame-work, or cassoon of timber, moored and shackled, which at the same time that it yields to the violence of the sea, also admits the waters to pass under, over, and through it, thereby dividing and breaking the waves, and reducing them to a harmless state—converting all within a crescent of such breakwaters, to still or smooth water.

2. It is free from the defects and injurious consequences, very commonly attendant on stone breakwaters and solid piers; such as the filling up or obstructing of harbours and channels by accumulations of sand, &c.

3. It can be laid down, and by means of it, harbours formed on any part of our coasts, even the most exposed and dangerous, where none at present exist, and where it is impossible by any other means to make a harbour.

And 4th. It can be constructed and kept constantly in repair, at a twentieth part of the cost and expense which all other breakwaters require.

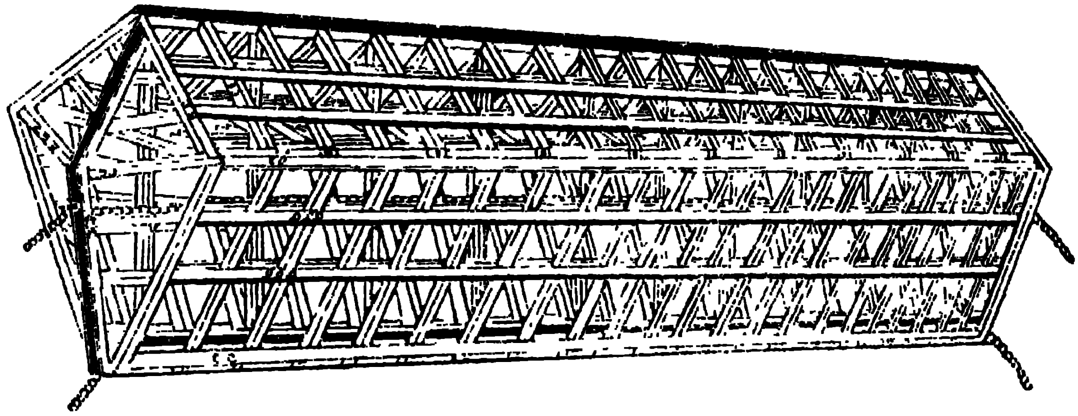
The following explanation of the accompanying engravings we extract from Captain Tayler's specification:—

Fig. 1 is a perspective view of a harbour provided with, or formed by means of Captain Tayler's floating cassoons.

Fig. 2 is a floating cassoon or breakwater, "to be used for deep water, where great buoyancy will be requisite for carrying the weight of the necessary moorings." A represents the keel; B the deadwood or keelson; C C an 8 inch bottom, bolted together, and the streaks next the keel are dovetailed thereto; D is an iron strap (or staple knee) outside, by which the keels of the timbers S S are bolted and secured through the keel and keelson; F F are strong fore and aft binders, bolted to the timbers S S, in a dovetailed or diagonal direction, and in the strongest manner; G G thwartship beams connecting the timbers S S; H is a small pillar under the beams; I is the keel of this floating cassoon, which rests on the thwartship beams; G K is the keelson; L L are the timbers of the cassoon; M M is a 4 inch red pine plank, rabbeted and bolted edgeways; N N is a 2 inch sheeting, put on so as to break the joints of the 4 inch rabbeted plank; O is a knee worked inside, and bolted to the keels of the cassoon timbers, and an iron knee, and that to the thwartship beams, and fastened as shown in the engraving, which secure the keel of the cassoon in a proper manner together; P P are fore and aft binders, fastened in the same manner as F F; R R is like a keelson fastened to Q Q, which represents a keel, but lying horizontally, and is fastened together, as shown through the iron breast-hook and the knee inside, and through the chocks, marked T T, between the timbers S S and the 5 inch rabbeted plank, and thus connects and secures the middle together. V, the upper part, represents the knee of a ship laid the reverse way, and secured as shown in the engraving. W is a pillar upon the beam G. The diagonal pieces, marked 1, 2, should be 12 inches square, and chased in the cassoon timbers at their ends, but let in half and half in the middle. The main upright timber, marked 3, is teroned like a pillar, but in the middle there is an iron plate worked in the inside, to connect the diagonal trusses or timbers, 1, 2, together. Out of the cassoon timbers L L a rabbet is to be taken each way, to secure the ends of the bulk-head planks, and the thwartship planks, and when caulked and secured, as shown in the figure, will in every respect be waterproof. This floating cassoon breakwater should be 18 feet beam and 31 feet deep: of which one-third will float above the surface of the water.

Fig. 3 is an end view of another floating breakwater, which is composed entirely of red pine timber, so arranged, that three-fourths of the quantity of the timber will be immersed in the water, and will thereby give a buoyancy (after carrying the top weight) of 7 tons to each length of 60 feet. Its total altitude will be 24 feet, floating 18 feet below

Fig. 6.



and 6 feet above the surface of the water, and 24 feet beam. A A, are the main upright timbers, 24 feet high, 12 in. by 10 inches. B B, the main thwartship beam, 24 feet long, 12 inches by 6 inches; one on each side of the uprights, A A, and halved into the same, 1 inch each way; the ends of all these timbers, A A and B B, are dovetailed, as shown in the engraving, and the ends of the main beams, B B are filled solid, by 6-inch dovetailed chocks. C C, double keel, each 12 inches by 8 inches, bolted in a dovetailed or diagonal direction to the upright timbers, A A, which are 4 feet apart. These keels are 60 feet long, and where they are scarfed or joined there is a solid dovetailed chock let in between them, so as to give additional strength. D D, is the deadwood, or keelson, running parallel with the keel, each 12 inches deep, 8 inches broad at top, by 4 inches at bottom. E E, are the timbers, say 9 inches by 6 inches, stepped on the keel and keelson, as shown in the engraving. There are binders, 40 of these on each side, which will leave them 21 inches apart, upon a section of 96 feet 6 inches. F F, are 8 inches by 4 inches, let in 1 inch into the heels of the timbers, E E, and bolted through the keelson, D D, and the main upright timbers A A. G G G, are strong fore-and-aft binders, 8 inches square, and let into the timbers, E E, 1 inch. But it will be more secure if these binders be placed inside and outside the timbers, E E, each to be 4 inches by 8 inches, and are treenailed or bolted together through the timbers, E E. H H H, are thwartship beams or braces, 10 inches by 5 inches, one on each side of the upright timbers; A A, being halved therein 1 inch each way. These support the fore-and-aft binders, and also the timbers. E E, are the fore-and-aft sheer planks, each 15 inches by 6 inches, which are bolted in a dovetailed or diagonal direction to the main thwartship beams. B B, K K, act as knees or braces, for connecting the upper and lower timbers, E E, together, into which they are tenoned. They are 10 inches by 6 inches. and are secured between the main braces, B B, taking a bearing on the fore planks. I I, is the line of immersion—the spaces between the timbers, E E, and the braces, K K, to be filled up with chocks running fore-and-aft the whole length, through which the timbers, E E, and the braces, K K, are to be bolted for greater security. All the bolts and fastenings are shown by dotted lines; the floating part above the surface of the water is similar to the lower, and will not require further description. The whole will be secured from working by diagonal braces, from sheer to sheer, *under* the floating or water line, with the exception of light fore-and-aft diagonal braces. Above that line, should it be found necessary to increase the buoyancy of this breakwater, it will only require hollow trunks made in any convenient lengths, say 20 to 30 feet, fore-and-aft. A square trunk of 1 foot in the clear on each side, running the entire length, will give an extra buoyancy of 5 tons; and if 2 feet square inside, equal to 20 tons. It is estimated that 42 loads of timber will be required for 93 feet 6 inches of

this breakwater, and that the labour will not amount to more than 40 per cent on the cost of the materials.

For attaching this breakwater to its ground moorings, there are two strong braces 7 inches wide, 1½ inch thick, one on each side of the upright timbers. These cross the top of the deadwood or keelson, DD, and rest thereon, and are bolted through the timbers. A double set of these are replaced on the second or third main timber, AA, from each end of the breakwater, and the mooring links are attached thereto by a 4-inch bolt passing through a shackle of sufficient strength. The mooring timbers or links pass through the breakwater, and hawser holes are fitted similar to a vessel. A separate view of one of the connecting swivels is given in Fig. 5.

The method of mooring either of these floating breakwaters remains now to be described. The present iron mooring chains, if of requisite strength, would be so ponderous that they would greatly increase the expense of the breakwater, without adding to its efficacy. It is assumed, that straight-grained timber will bear a much greater strain or tension than an equal weight of iron, and therefore it is proposed to form the moorings chiefly of the former material; for this purpose, straight-grained red fir, larch, or American ash in 12 feet lengths, is supposed to be best adapted. The centre-piece, as shown in the engraving, and marked Fig. 4, is 9 inches deep, and 4½ inches thick, on each side of which are the pieces, *bb*, each 9 inches deep, and 2¼ inches thick, making the whole 9 inches square; and these three pieces of plank or timber are united together by square flat iron hoops, *ee*, which should be driven on red hot, in order that they may become perfectly tight by their contraction when cold. At each end of the centre-piece, *aa*, are three saw cuts about 2 feet long; into the centre cuts an oak wedge, *f*, is to be driven, so as to spread all the timbers about 4 inches, forming a dovetail, as shown in the figure. Before driving these wedges, the strong flat iron hoops, *ee*, and the staples, *f*, are to be placed in their respective positious, and brought tight by the wedges. The staples, *ff*, should be made of inch square bar iron, 2 feet long, the holes or eyes 2 inches in diameter, to receive a bolt of that size; they should be flush, or be let into the timbers; they are turned up, or welded double at the ends, so that they cannot be drawn from the hoops, EE, without compressing the timber. These moorings are shackled together by a link of common mooring chain, of the requisite strength, between each. The specific gravity of these moorings (exclusive of the connecting links) will not exceed 20 per cent. above that of the water in which they are immersed. In order to render the timbers more durable and impervious to the worm, they are recommended to be steeped in a warm solution of sulphuret of lime, and joined together with hot vegetable or coal tar. Where the rise or fall of the tide is considerable, it will be necessary to have a certain length of common chain to connect these moorings to the anchors or mooring blocks, as they are never intended to strike the ground, but merely to act as an intermediate connection between the breakwater and its fastenings or anchorages. Fig. 6 is a perspective view of a cassoon in its complete state, when out of the water. When afloat, the water reaches as high as the point A.

For in-shore protection, or where the ebb tide leaves the beach dry for any considerable distance, a breakwater, similar to that represented in fig. 3, but of less beam or breadth, is thought to be most suitable; its altitude will depend on the depth of water, as it proceeds from the shore, or the rise of the tide. To secure it in its position, a double row of strong piles are directed to be driven in a diagonal direction, 4 feet apart at top, and 8 feet apart at the points; the heads of these piles are to be connected by two pieces of strong timber, halved in each way, and securely bolted together through the pile heads. These to be run out beyond low water. They should stand about 2 feet above the surface of the beach, and each set are to be placed about 12 feet apart. On these the breakwater rides, and it is secured thereon by strong straps and bolts, which hold it firmly down, but which do not prevent it from rocking or

vibrating sideways. From the top of each length of this breakwater are two lengths of chain or mooring, carried out on each side to any convenient distance, and they are left slack to allow the breakwater to rock on its keel or base, and thus yield to the force of a heavy sea. The breakwater is angled off to 4 feet at the ends, and fitted with hawse-pipes, similar to a ship, through which pass the mooring timber pieces, or chains; and it is to be moored to receive the force of the sea in an oblique direction. If it were possible for one of the moorings to give way, the section it belonged to, would, it is stated, merely swing end on, and ride secure, leaving an opening equal to one-third of a section.

## E. A. M.'S NEW THEORY OF THE UNIVERSE.—FURTHER ILLUSTRATIONS.

Sir,—Proceeding on the assumption that the metallic fluids are metallized heat, we may trace their original source to vegetation. Heat, during its passage through an aggregation of atoms, would attach other atoms to it under various forms, and some of those forms would be those of the metallic fluids.* Under such circumstances, varieties in the proportions of heat would occur, and consequently varieties in the forms of material bodies. The earth and the waters were designed to "bring forth," and they brought forth, (according to the predisposition of matter by the Almighty Creator,) *all*, with the exception of the soul of man. I cannot presume to enter into the mysteries of chemistry; but, from a general view, it appears to me, that the metallic fluids being formed, that which had assumed the form of iron would be most *lasting*, and require most heat; and, therefore, after the completion of creation, would have its principal continuing source where there was most heat to be acquired. Hence we find, I believe, a magnetic equator not far from the other, not exactly the same, from many causes. Ironized heat, in accordance with my theory, would be found the most universally diffused of fluids, existing, more or less, in all living matter; giving the beautiful blue tint to the sky, and producing that most interesting of metals, the aerolite. Must not the classical reader, in this extraordinary production of the firmament, be reminded of the mythology of Rhea, (*i. e.* the earth,) giving Saturn, (*i. e.* the firmament,) a stone, instead of his son, to gnaw. But fable must be avoided. Like an idol, it is too apt to have attached to itself that of which it is only the symbol. Our business is with *truth*, as it is to be obtained by a comparison of facts, independently of prejudice or of a reverence for the talents of the illustrious author of the theory of gravitation, whose soaring powers would never have bound his wings on the top of his own ladder—who doubted, himself, whether an error had not crept into his speculations—error, just enough to prove his intellects were human, and one which, but for *death*, he would probably soon have corrected, as being a retarder, rather than a furtherer of his system. But I am encroaching too much on your valuable pages.

I remain, Sir,

Your obliged and obedient servant,

E. A. M.

November 2, 1841.

* May not this be what is meant by "The ground shall not henceforth yield *her strength?*".

## WHEELS WITH WOODEN TYRES.

Sir,—Having been instrumental in eliciting some correspondence in your interesting Magazine, on the subject of locomotive engine wheels having *wooden tyres*, I now beg to inform you that a pair of them, constructed in the house in which Mr. Dircks was a partner, have been put to the test of actual trial on the Liverpool and Manchester Railway, and the result was a failure. They did not run much more than a week before palpable symptoms of giving way took place; the timber began to crush and fly off in splinters, and the wheels consequently became untrue, and not safe to run; they were consequently taken off. This information I have to-day received from the superintendant of the locomotive department.

I think it only due to you and the public to make this statement, affording another proof, if, indeed, another can be wanting, that a little practical experience is worth a vast deal of speculative theory.

I am, Sir, your obliged servant,

S. S.

Manchester, November 1, 1841.

## ON THE PERFORMANCES OF THE CORNISH ENGINES, IN REFERENCE TO MR. PILBROW'S CONDENSING CYLINDER ENGINE—WITH REMARKS ON MARINE ENGINES.—BY BENJ. CHEVERTON, ESQ.

Sir,—Notwithstanding Mr. Pilbrow's observations in reply, I am still disposed to think, that he indulges in extravagant expectations in regard to what may be the performance of his Condensing Cylinder Engine, when he

rates it at double, and, still more, at treble the duty that can be done by crank engines, not having his improvement. I do not refer to the ordinary duty of these engines, because there is generally, and particularly in locomotives and steamers, a great waste of power; nor do I refer even to the best performances of the crank engine, because, I think, that by greater attention to minutiæ they may yet be very considerably increased; and this limitation of my assertion is perfectly fair in itself towards Mr. Pilbrow, and is, in fact, no other than what he himself adopts, for his expectation is, he says, "to do double the duty at the lowest, or any calculation *that can be founded on scientific investigation.*"

Mr. Pilbrow, in defending himself from the charge of extravagant expectations, relies on the superior performances of the Cornish lifting engine to those of the Cornish crank engine, and very pertinently, and not unfairly, pits against me my own observation, that the superiority depends *alone* on the more perfect evacuation and condensation of the steam; which objects are precisely those that Mr. Pilbrow alleges will be obtained by his improvement. He accordingly quotes, from Lean's Reports, the best duty of the crank engine at 70,908,981 lbs., and of the lifting engine at 123,300,593 lbs., and relies on this statement as the warrant for, and the measure of his expectations. A few observations, therefore, are necessary in explanation.

I would first observe, that the above numbers are in the ratio of 1 to 1·7, which is not exactly that of 1 to 2, much less that of 1 to 3.

In the next place, the comparison is, by admission, to be founded, not on the actual performances, but on the scientific capabilities of the respective classes of engines. When I stated that the superiority depended alone on the more perfect evacuation and condensation of the steam, I of course meant, so far only as *construction* is implicated in the results. With the particular management of the several engines, whether good or bad, we have nothing to do; and yet it is on this, far more than on construction, that the result in practice depends. This is evident, not merely from the great progressive increase of duty since the commencement of the reports, (the general system being the same,) but from the vast difference in the amounts of duty, by engines of similar character under like arrangements, even at the present time. The state and quality of the fuel, the state of the machinery for pumping, the state of the engine, the *degree* of attention to the fire, the *degree* of expansion, and the intermitting or the continuous working of the engine, are among the practical conditions on which the actual performances depend; and which are altogether independent of the real merits of the engines, either in themselves or in their adjuncts;—which latter comprise, the *systematic* treatment of the fire, the construction of the boiler, the economising of caloric, and the using expansion. These, therefore, may be, as I stated, the same for both classes of engines, and yet the practical results be dependent, in a very great degree, on the more or less judicious management in regard to those other items, which I have just enumerated, as among the practical conditions of the actual performance. It is to the adjuncts, I apprehend, that we must look for the difference in the performances between Cornish engines and others;* and it is among the items of management, that we must seek for the differences which exist among themselves, and for that between the Cornish lifting and the Cornish crank engine, over and above what arises from the more imperfect evacuation and condensation in the latter. If it were not so—if the influence of management and careful attention were excluded, Lean's Reports might be brought to prove the contrary proposition—namely, the superiority of the crank to the lifting engine, even though the best and the worst were not taken for the comparison, but the average performance of the latter, with the best of the former; for the treatment of the fire, the construction of the boiler and the other adjuncts, can be stated in behalf also of this proposition, as being the same for both classes of engines.

I repeat, therefore, that the superiority of the lifting engine is due alone to the more perfect evacuation and condensa-

* See a notice in No. 950 of the Magazine, for a statement of a reduction in the consumption of coals from eleven tons to four and a half tons per week, by substituting a Cornish boiler, accompanied, no doubt, with the Cornish system of treating the fire

tion of its steam, but maintain, nevertheless, that only the broad fact, and not the amount of such superiority, can be ascertained from Lean's Reports, inasmuch as the merits of construction are mixed up and confounded with the merits of management. Mr. Pilbrow ought to have been aware of this himself, if for no other reason than that he took for comparison, as he was entitled to do, the best performances in each class of engines, thereby tacitly acknowledging that his object was to exclude, in some measure, the influence of management from appearing in the results. I confess, however, I am inclined to think that the very best performances are frequently *too good*, and I ground this opinion on the great disparity between these facts and the average amount of duty. There is either a little manœuvring in the one case, or a great want of attention in the others, unless indeed the intermissions, through accidents, or other causes of interruption, vary so greatly in a month's work as to account for the greater part of the difference. However this may be, the crank engine has evidently not yet done its best, by a great deal; whilst the lifting engine shows symptoms of having pretty nearly attained to its maximum of performance. It has gone on improving for a great number of years, but it is only lately, comparatively, that the crank engine has taken a decided start in the race. I have not the Reports to refer to, but if I recollect rightly, it was only a few years ago that the greatest duty was twenty millions of pounds, and now it is seventy. Let this class of engines have for a few years to come, the same degree of attention bestowed upon them that has been lavished on the other class—let them fairly have the opportunity of working continuously to an equal amount, with a like participation in other extraneous influences,—and the performances eventually will not fall so far short as Mr. Pilbrow imagines, or as the Reports at present and in the gross appear to indicate. The difference will disappear, except such as arises from the different facilities afforded by the construction for evacuation and condensation, which, amounting probably to a pound or two on the inch, will not affect very largely the returns of duty. Mr. Pilbrow, therefore, must not appeal to reports which implicate management more than construction, and which were expressly instituted in order to obtain criteria of such management, as well as to stimulate exertion in that department; but he must appeal "to calculation founded on scientific investigation," as the self-admitted and the only rational arbiter of the merits of his invention, until experiment shall more legitimately and more satisfactorily sanction the justice of its award.

But, thirdly, even that loss, which I have just admitted, as being incurred at present by the Cornish crank engine, is not so inevitably connected with its construction, that it may not be made less than it is, by a more judicious arrangement and a better mode of working. Let us take for example the instances quoted by Mr. Pilbrow from Lean's Reports. The velocity of the piston of the lifting engine is 113·4 feet per minute, whilst that of the crank engine is 159·84 feet per minute; but this ratio of 1·0 to 1·4 does not give inversely the ratio of the times of evacuation and condensation for the respective engines: for it must be remembered, that the strokes of the lifting engine are irregular in speed—the efficient one being the most rapid; and also, that a pause ensues before it commences, so that double the time may be fairly allowed as being taken by it, for the evacuation and condensation of its steam. This is a great difference in a most important particular, and is quite conclusive against that similarity of circumstances, in which Mr. Pilbrow represents the two engines to be placed; for the times could be equalised, notwithstanding the pause and the construction, and this is the ground on which they ought to stand for a fair comparison. At any rate, the speed of the piston ought in each case to be the same. Then, there is the circumstance of the area, to say nothing of the capacity of the cylinder of the lifting engine being six times greater than that of the crank engine; to which may be added, others that possibly exist, of which we are ignorant, such as a difference in the extent to which expansion in each case was carried, and circumstances connected with fuel and management. And thus it is easy to conceive, that the difference in duty be-

tween 71 millions and 123 millions, may in a very small degree be occasioned by the *construction* of the engines.

The proper direction to be taken by the Cornish engineers, with a course of improvements in the performances of the crank engine, and of the propriety of which they appear to be fully sensible, is, to adopt the single stroke form, to moderate its speed, to expand the steam to the greatest extent that shall be found practically useful, and to so proportion the magnitude of the engine and the boiler to the work, as not to necessitate the urging of either beyond the maximum performance in reference to the unit of coal consumed. This is precisely the direction which they have followed in augmenting the duty of the lifting engine. Neither the boiler nor the engine is overworked. In the contrary direction are the locomotives and steamers, which, for the sake of velocity, are pushed to the utmost, both in regard to the speed of the piston, and the rapidity of combustion; so that economy being disregarded in order to secure the greatest efficiency in relation to time and space, the duty becomes correspondingly low. In other cases efficiency in these relations is aimed at because a short-sighted parsimony prevails, which prefers a greater current expense to a larger outlay in the first instance, or which at any rate incurs it, whether it prefers it or not. These explanations, coupled with the absence of other minor adjuncts, are, I think, quite sufficient to remove any mystery that has been supposed to attach to the superior performances of the Cornish engines.

Circumstances of exigency may, however, be paramount to every other consideration, and may compel the sacrifice of economy to some extent, in order to obtain the greatest efficiency of which the boiler is capable by hard firing, and of which the engine is capable by rapid movements, and the abandonment of expansion. It would be unjust, therefore, to Mr. Pilbrow (for I would not wish to appear as the mere partizan, either for or against any new project) not to point out that possibly in *these* cases his improvement may be found to be, of some value, although when working under the best circumstances, it may confer little or no advantage on the crank engine. For instance, let a first-class steamer be provided with much greater power in proportion to tonnage than is usual, so far, at least, as the *capabilities* of the engines and boilers are concerned—this object, since the introduction by Mr. Seaward and others, of greater compactness in the form, can be obtained, and a greater *efficiency in relation to space* be secured, without having recourse to those overworking wasteful expedients just described. This state of things will permit the power at command to slumber in the consciousness of its might, and so, with a putting forth of no greater amount than has heretofore been the practice, it will allow the important object of the greatest *efficiency in relation to fuel* to be consulted, by an adoption of the Cornish system of slow movement, slow combustion, and great expansion. The two former presupposes among the adjuncts large paddle-wheels and large boilers. In this state of things it may be of little consequence whether the engines have, or have not, Mr. Pilbrow's improvement; but we will suppose that circumstances of exigency arise, in the shape of a strong head wind, a heavy sea, or a lee shore, or all combined, peremptorily demanding the *greatest efficiency in relation to time*—then must the human-hand-and-mind-created power, be aroused in all the majesty of its strength, to conquer the hitherto unconquerable. Expansion must be discarded, and the waste of fuel must not be heeded, that so the manifestation of its might may be both rapid and strong. But unfortunately, in this very development of greater power, and by the very conditions on which it is obtained, there is a weakness engendered to detract too sensibly, and most inopportunely from its amount. To strive to get the regular velocity, or an approach to it, under such circumstances, is to practise true economy. Wasteful though it may be, as a mechanical effort, and also in reference to fuel, yet it will be a means of saving in reference to time and ultimate results.* To regain, therefore, in some measure, the power that is then lost, is not only ir-

* It is well known that a steamer with too little power is less economical than with a greater power, in the long run.

valuable in itself on such emergencies, as an acquisition of more power, but it is valuable as a saving of fuel, not merely in reference to the time being, in the additional mechanical effort gratuitously afforded, but in reference also to the time of the voyage, diminished in proportion to the increased velocity, to which are to be added the collateral benefits thence arising. At such times the condensing cylinder would be a valuable improvement, if it prevented power from being lost to the amount of only one or two pounds on the square inch, and it is not improbable that it may effect this, when such a system of working is resorted to. I am, however, of opinion that in competition with the more profitable mode, it is extremely problematical whether the slightest advantage will arise, inasmuch as the waste of power is then much less, the saving is relatively less, and the relative friction, arising from the additional contrivance, is greater.

The course of proceeding just sketched, for improving the performances of steamers, is that in which the first great advance was made in the *Great Western*. It is to be hoped that further progress will be made in this direction, and that the remarkable success attending it will not be attributed, as I fear it was, in some subsequent instances, merely to the magnitude of the vessel. The practical skill and acumen displayed in all its departments completely baffled the short-sighted calculations of Dr. Lardner, so characteristic of a mathematician, and added another attestation to the fact, illustrated in every page of the history of the useful arts, that invention and enterprise receive no impetus in their career from scholastic science.

The further observations I have to make must be reserved for another communication.

I am, Sir, yours, &c.

Benjamin Cheverton.

## FARTHER PARTICULARS OF MR. EDWARDS' METHOD OF TRANSFERRING DAGUERREOTYPE TO PAPER.—(SEE P. 203.)

Sir,—As you have considered the notice I sent you of a method of transferring daguerreotype to paper, worthy of insertion in your Magazine, I am induced to offer the following additional particulars of the process, which I find by experiment to produce the best results.

The greatest difficulty I have had to get over arose from the adhesion of the paper to the plates. This, however, I have entirely overcome. To prepare the plates, as originally described by Daguerre, *oil* was used with the pumice powder, then the dilute acid, and after the plate was heated the dilute acid was used again; the polishing with oil, having, however, been found to be rather a dirty operation, and the dilute acid to answer the purpose as well, oil is, I believe, now rarely used. It however occurred to me that the use of oil for polishing might facilitate the removal of the papers from the plate, and the result has answered my expectations. For the last polish to a plate to be transferred, as small a quantity of oil as will give a uniform coat to the plate should be used with the pumice (or tripoli) and carefully cleaned off with renewed pledgets of cotton. The plate being then polished with charcoal and rouge on velvet is ready for the iodine box.

Isinglass, or "Nelson's Gelatine," I find answers best for transferring. The common black paper being pinned upon a board, is washed over very carefully (so as to avoid bubbles) with a warm solution of the isinglass, and a better coat is obtained by two weak washes than one too thick. The paper thus prepared may be kept any where in a dry place. When required for a transfer it is only necessary to dip it for a few minutes in cold water, and lay it very carefully upon the plate; the superfluous water may be removed by carefully pressing it with blotting-paper. The plate must then be placed in a press, with several folds of blotting-paper over the transfer-paper, and kept well pressed till the isinglass has set, say for about half an-hour. On being taken out and dried in the sun, or before a fire, the transfer spontaneously separates itself from the plate, upon which (if the process has been properly performed) scarcely a trace of the picture will be left.

For want of a suitable press I use a pair of strong wood clamps sufficiently

large to take the plate between them, and for a couple of steady pins (to prevent lateral motion) I nip the clamps in a common vice.

I am not without hopes of some method being discovered of improving the intensity of the transfers thus made, which are at present very inferior to the originals. The effect of a transfer taken upon *white paper* is very curious; it is more vivid than upon black, but becomes a *negative* picture, the mercurial film which depicts the *lights* in the daguerreotype, showing upon the paper a dirty grey colour. These transfers might, I think, be coloured by hand after nature. I am, Sir,

Your obedient servant,
G. EDWARDS.

Lowestoft Harbour, Oct. 23, 1841.

## THE SUGAR MANUFACTURE—MR. ROBINSON'S PATENT IMPROVEMENTS.

SIR,—As your pages are ever open to the investigation of the merits of new inventions, as well as to the announcement of their too often unheeded existence, I take the advantage of them to call in question the "improvements" in Mr. Robinson's Patent Sugar Cane Mills.

The qualities of different canes are so various,—depending not only upon the age of their growth, but upon the kind of seasons which they have enjoyed,—that no average of juice can be given, compared with the weight of the green cane. But I deny that, in any case, an ordinarily well made three roller mill, with iron framing, leaves any available portion of juice unexpressed. Neither can I see any rationality in the scheme of improving matters by deluging the canes with hot water in their passage through the rollers; for, as every planter well knows, there is abundance of watery particles already in the juice, and it is this which causes such a vast consumption of fuel in the process of evaporation. This part of the invention, at least, will, I venture to predict, remain a dead letter.

But "breakage," we are told, "is a *common* accident" attending the ordinary cane-mills. I consider this to be an undeserved libel upon our engineers, for although engaged in the manufacture of sugar-mill machinery for many years, there has not an instance occurred, within my knowledge, of that machinery having required renewal or repair. The new means by which it is proposed to obviate such injurious tendency to breakage, is to make use of wrought iron bars, and to increase the number of rollers. As far as regards the former improvement, it is already almost universally in use. I have never yet made a sugar-mill without wrought iron bars, and consider them essential to security. Then, as regards the number of rollers, it is obvious that the pressure between the two last rollers of the new mill must be equal to that used in the present mill, otherwise there will be a diminution of effect; therefore the strain on the axles of these rollers must be equally great; and whatever additional pressure is applied by intermediate rollers, can only add to the present strain on the straps and side frames. The whole invention, it seems to me, can tend only to increase the fancied liability to derangement instead of diminishing it. But further, to avoid the enormous mass to which such a complicated machine as Mr. Robinson's patent mill inevitably tends, the pressing rollers are shown excessively small in diameter. Now it is well known that this is a real evil, and one which offers the most serious impediment to an efficient sugar mill. The ordinary sized rollers possess all the advantage of gradually drawing in the canes which any number of small rollers would in vain strive to effect, whilst the length of time during which the canes are under pressure, in consequence of the greater flatness of the curves, secures the most complete expression of the juice.

As to the objection, that in the ordinary mill the juice is thrown forward between the first rollers, I cannot see, supposing such to be the case, and that it is really a matter of importance, how there can be any different effect in the new mill; I rather think that in this case we are exactly upon a par.

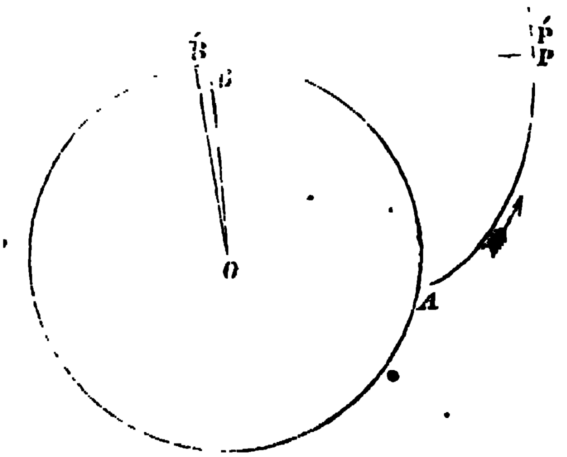
The next improvement is in the cane carrier, a machine which is always used to convey the canes up an acclivity to the mill, but which can never be depended on to supply the canes regularly

and equally to the feeding rollers. It will be equally expensive to arrange the canes upon one extremity of Mr. Robinson's band, as it would be upon the ordinary feeding-board, whilst the certainty of good effect would be much diminished, and from the extreme irregularity in the pieces of cane, the most ingenious attempt at a self-acting feeding apparatus will be completely baffled.

I remain, Sir, yours respectfully,

A. B. C.*

## SOLUTION OF THE MECHANICAL PROBLEM—(VOL. XXXIV, P. 26.)




Sir,—The following simple application of the calculus will furnish an answer to the question of "Amicus," at page 26 of your 935th number; premising that it is better to consider that the cord is to be *uncoiled from* the cylinder, instead of wound upon it.

Let A B be the cylinder, from which the cord is to be uncoiled from A, as a starting point, in the direction of the arrow, until 300 ft. have been unwound; of course the diameter of the coiled circle is supposed to remain constant at 3 feet, otherwise data would be required, besides what your correspondent has given.

Take any point, B in the circumference; draw the radius B O, and, perpendicular to it, the tangent B P; make B P equal to the arc B A, then will the line B P represent the portion of rope uncoiled from A to B, and P will be a point in the curve formed by its evolution. Suppose then, an infinitely small farther uncoiling to take place, from B to B′; draw the radius B′ O, and tangent B′ P′, as before, and another point P′ in the curve is obtained; the distance P P′ being the elementary increase of length gained by the required curve, for a corresponding elementary increase of the length uncoiled.

But in these infinitely small distances, the arc B B′ may be supposed to coincide with its tangent, and to become a right line perpendicular to B O; and on the same principle, the small curve P P′ may also be supposed a right line perpendicular to B P. The lines B P, B′ P′ being moreover respectively perpendicular to B O, B′ O, the two elementary triangles B′ P P′, O B B′ are similar, and therefore O B : B′ P :: B B′ : P P′.

Now let $r$ = B O the radius of the cylinder.

$\theta$ = B′ P or B′ A, any length of rope uncoiled from it.

$\lambda$ = corresponding length of required curve P′ A.

And let $d\,\theta$ = B B′, elementary increase of length uncoiled.

$d\,\lambda$ = P P′, corresponding elementary increase of required curve.

Then we have as above,

$$r : \theta :: d\,\theta : d\,\lambda,$$

$$\text{or } d\lambda = \frac{\theta}{r}\, d\,\theta.$$

Integrating this expression therefore, we find

$$\lambda = \int \frac{\theta}{r}\, d\,\theta = \frac{\theta^2}{2r} + \text{const. and}$$

since $\lambda = 0$, when $\theta = 0$. Const. must be also $= 0$.

Wherefore we obtain this rule—the length of the curve described by the end of the rope in uncoiling, is equal to the square of the length uncoiled, divided by the diameter of the cylinder.

So that in the case proposed, the distance the person must travel will be

$$\frac{300^2}{3} = \frac{90,000}{3} = 30,000 \text{ feet, or about}$$

$5\frac{7}{10}$ miles.

I am, Sir, yours obediently,

W. POLE.

Great Russell-street, October 8, 1841.

* Will our correspondent have the goodness to send to our office for a letter addressed to him?

## MR. PRATER'S THEORY OF THE INHERENT ACTIVITY OF PARTICLES OF MATTER.

Sir,—Mr. Prater, in his note to his essay on inherent activity as a property of the particles of matter, (page 217 of your present vol.) appears to me much more ingeniously than ingenuously to have endeavoured to prove that in that essay he attributed the inherent activity of the particles of matter to heat, and that there really is not so great a dissimilarity of opinion between us as at first appeared. He has also attributed to me statements that I have not made, and abstracted or withheld from those statements which I did make, the several prominent causes which I assigned for the motion of the several classes of the atoms of which all material bodies are composed. Now I think every one of the readers of your interesting work, (except, perhaps, Mr. Prater himself,) who has read the essay in question, as inserted in your 32nd vol., page 569, or who may feel inclined to refer to it, will come to the conclusion that Mr. Prater did therein endeavour to inculcate the opinion that the long received doctrine among philosophers relative to the *vis inertia* of matter was erroneous, and that he had discovered, on the contrary, that the particles of matter are possessed of a power of inherent activity; in support and proof of the correctness of which theory he referred to sundry experiments, and their resulting effects. I think, also, that the same readers of your work will remember, or perceive, on reference to my communication in reply, as inserted in your 33rd vol., page 3, that I gave it as my opinion that the atoms of material substances possess no inherent power of activity, as opposed to gravity—that such substances are composed of ponderable and imponderable atoms—that the ponderable atoms are subject to the laws of gravity, affinity, simple attraction, attraction of aggregation, and attraction of cohesion—that the imponderable atoms of caloric are subject to the law of equal diffusion—and that to these several laws the motion of both the ponderable atoms of matter, and the imponderable atoms of caloric may justly be attributed.

What I conceive I have just reason to complain of in Mr. Prater's note is, that he has endeavoured to make it appear as if I had expressed an opinion that the addition of heat to matter is always the cause of its motion; and by withholding much that I did state, has left the inference to be drawn that I conceived that the impartation of heat alone was the cause of the motion of matter.

As the residue of Mr. Prater's note appears to me to be a laboured, and by no means a consistent essay, to prove that he really did not mean to endeavour to inculcate the idea that the particles of matter are not inert, and that, on the contrary, they possess the power of inherent activity when "unrestrained by cohesion, atmospheric pressure, or other forces," (as it is quite evident the author to the title of his essay in your 32nd vol., understood him to mean to convey) and that instead of teaching such a doctrine, he meant to convey the idea that he attributed the motion of such particles of matter to the impartation of heat, or to the residence of latent heat among the constituents of atoms of bodies; and as I have already fully expressed my opinion on the subject in former communications, I will not presume again to trespass on the time and patience of your readers, or your valuable space, by a recapitulation of them. I will therefore conclude with a recommendation to Mr. Prater, that he should either adhere firmly to his first opinions or remain perfectly silent respecting them; or, if he has abandoned them, and is not content to be again unread upon the subject, then, frankly to acknowledge conviction, and consequent change. I am, Sir,

Your obedient servant,

G. H. WIGNEY.

Brighton, October 23, 1841.

## ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

*** *Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for that purpose.*

JOHN BARKER OF REGENT-STREET, LAMBETH, ARTIST, *for improvements in measuring aeriform or fluid substances.* Petty Bag Office, October 20, 1841.

The substances to be measured enter a cylinder, in which a piston travels to and fro, being admitted alternately before and behind the piston. Two side links, connected with a cross-head on the piston-rod, work in guides attached to the side of the cylinder, and carry studs, or tappets, which strike against vibrating levers, and thereby alter the position of the valves. So that, as the piston traverses to and fro within the cylinder by the pressure of the fluid, its reciprocating movement shifts the position of the valves, converting them alternately into exit and entrance passages, the fluid escaping by a pipe beneath the cylinder. A double rack on the end of the piston-rod, works alternately into a toothed wheel having the teeth removed from one-half of its circumference, and which is caused to revolve by each rack alternately engaging the teeth remaining on its rim. A pinion on the axis of this wheel con-

veys the motion of the apparatus to a train of wheels which register the number of strokes made by the piston, and the contents of the cylinder being known, the quantity of any fluid which has passed through the machine is thereby indicated.

HUMPHREY JEFFERIES, OF BIRMINGHAM, BUTTON MAKER, *for improvements in the manufacture of buttons.* October 22, 1841.

These improvements relate to the manufacture of covered buttons. A metal shell being formed with a groove at the back near its edge, a central hole is punched, its sides being struck up into a kind of tube; this tube is inserted through the centre of a silk or other disc, which is to cover the back of the button, and the sides of the tube being pressed down upon it, holds it securely. A flexible shank with two surfaces of button board attached is then placed in the shell, the shank protruding through the central aperture; the shell is then placed on a disc of the covering fabric, the edges of which, as well as those of the back disc, are forced into the recess at the back of the shell, and secured by doubling down the edges of the recess upon them.

In another mode, a disc of copper is formed into a ring or hoop, with a grove round its back, which is laid on a disc of any suitable fabric, the edges of the fabric being forced into the groove and secured there by doubling down the sides itself.

The claim is—1. To the mode of manufacturing covered buttons by dies and pressure, by employing metal shells, having a circular groove or recess.

2. To the mode of manufacturing covered buttons by dies and pressure, by applying back coverings thereto, with holes for the passage of the shank.

3. To the mode of manufacturing buttons by dies and pressure, by employing circular rings and fabric as described.

THOMAS HARRIS, OF HALES OWEN, NEAR BIRMINGHAM, HORN BUTTON MANUFACTURER, *for improvements in the manufacture of what are called horn buttons, and in the dies to be used in the making of such descriptions of buttons.* (Partly a communication.) Enrolment Office, October 22, 1841.

The nature of these improvements is sufficiently apparent from the claims made, which are as follows:—

1. To a mode of manufacturing horn buttons with flexible shanks; by first forming buttons by pressure and heat, and then by a second pressure in dies to affix flexible shanks thereto.

2. To a mode of ornamenting horn buttons, by causing suitable surfaces to be affixed in their front surfaces, by pressing the buttons with the ornaments in dies.

3. To a mode of ornamenting horn buttons by gilding or silvering their surfaces.

4. To a mode of constructing dies used in the manufacture of horn buttons, by applying separate bounding circles to each engraved surface for a button.

5. To a mode of manufacturing horn buttons in dies, wherein the horn is prevented from being expressed at the circumference of the button as described.

HENRY BROWN, OF CODNOR PARK, IRON WORKS, DERBYSHIRE, IRON MANUFACTURER, *for improvements in the manufacture of steel.* Enrolment Office, October 22, 1841.

The crude metal is first reduced to a fine granulated state by the puddling process; after being sifted, it is submitted to cementation in the following manner:—A number of wooden frames, about an inch deep, are provided, rather smaller than the cementing pots, and a layer of granulated wood charcoal about half an inch thick being spread over the bottom of the cementing pot, it is covered with paper and one of the frames laid thereon. The frame is then filled with the granulated iron, and so on alternately charcoal and frames of iron, till the pot is nearly full, the charcoal at the top being three or four inches deep. The pot is then closely luted down with loam. The cementing furnace being filled with these pots, it is kept at a very high temperature until the steel is converted. When cold, the pots are opened, and the cakes of steel which have been formed in the frames are broken up and melted in the usual manner.

The claim is to the mode of manufacturing steel, by obtaining iron in a granulated state by the means described, and submitting the same to cementation by carbon.

JOHN ROSTRON, OF EDENFIELD, LANCASHIRE, AND THOMAS WELCH, OF MANCHESTER, MANUFACTURERS, *for certain improvements in looms for weaving.* Petty Bag Office, October 22, 1841.

The first of these improvements consists in removing the usual wire spindle, or guide for the picker, from the lathe or slay, and substituting a top rail, or guide piece, for the purpose of forming a box for the picker; by which arrangement the picker runs freely, and with considerably less friction than heretofore.

The second improvement relates to an improved picker, and consists in forming a picker of leather, with a projecting rib beneath it, which runs in a groove cut in the slay to assist its direct course.

The third improvement consists of an arrangement of mechanism for producing a regular variable letting off, or giving out motion of the yarn beam.

The fourth improvement consists in the application of a helical, or spiral spring to the

axis of the cloth beam, in order to allow the cloth to yield, whilst the sheds are being formed, and afterwards to tighten itself when the sheds are finished. This improvement is to be used in conjunction with the preceding, which has otherwise no provision to allow of the yielding of the yarn, while the sheds are formed.

LANCELOT POWELL, OF CLYDACH WORKS, BRECON, IRONMASTER, AND ROBERT ELLIS, OF CLYDACH, AFORESAID, AGENT, *for certain improvements in the manufacture of iron.* —Enrolment Office, October 24, 1841.

The first of these improvements consists in boiling iron in a boiling furnace, to which it is conveyed immediately from the blast furnace in a molten state.

The second improvement consists in passing or driving a stream of atmospheric air upon and over the surface of the iron, as soon as it is in a boiling state, for correcting the red-short quality to which iron is liable that has not gone through the refining process; and for more expeditiously bringing the iron into a malleable state. The blast is continued during the processes of boiling and fermenting, but is discontinued previous to the operation of balling.

The bridge of the boiling furnace is about 9 or 10 inches higher than in the ordinary puddling furnace, by which means the iron is prevented from running over the bridge, and an opening is made near the bottom of the furnace for drawing off the scoria.

The claim is, 1. To the manufacture of malleable iron, by subjecting the iron to the operation of boiling, in addition to those of puddling and fermentation; which iron is conveyed in a molten or red hot state immediately from the blast furnace, to a boiling, or reverberatory furnace of the particular description or construction above mentioned, or of any other suitable construction; also, by subjecting the iron in the boiling furnace to the action of a blast of atmospheric air, as described.

2. To the passing or driving a stream or blast of atmospheric air upon and over the surface of the metal, for the purpose of assisting in the purification of the same, and rendering it malleable, whilst under the operation of boiling, puddling, or fermenting, in a reverberatory furnace, of any description or construction.

FLORIDE HEINDRUCKX, OF FENCHURCH-STREET, ENGINEER, *for certain improvements in the construction and arrangement of fire-places and furnaces, applicable to various useful purposes.* Petty Bag Office, October 24, 1841.

Instead of the fire-bar of ordinary furnaces, the patentee constructs his furnaces with inclined sides, leaving an opening at the bottom the whole length of the furnace. The fuel descends by its own gravity towards this opening, through which the air enters the furnace, and passing through the mass of ignited fuel, effects its combustion.

For the purpose of regulating the combustion of the fuel, a long cylindrical bar, supported in suitable bearings, is placed beneath the air opening. Two sides of this bar are deeply indented, forming openings through which air enters the furnace; but when these indentations are turned round, and the plain part of the bar brought under the opening, the air is excluded, and the fire extinguished, while, by the partial closing thereof, the rate of combustion can be controlled at pleasure.

The claim is, 1. To the suppression of the usual fire-bars of furnaces, and instead thereof, forming the furnaces or fire-places with inclined sides, as described. Also the improved construction of furnaces or fire-places, whatever use they may be applied to, whereby the fuel, or other materials, descend by their own gravity towards the opening at which the air to support combustion enters.

2 To the use of a bar or shaft to regulate the combustion of the fuel.

JOSEPH GIBBS, OF KENNINGTON, CIVIL ENGINEER, *for a new combination of materials for making bricks, tiles, pottery, and other useful articles, and a machine or machinery for making the same; and also a new mode or process of burning the same, which machine or machinery, and mode or process of burning, are also applicable to the making and burning of other descriptions of bricks, tiles, and pottery.* Enrolment Office, October 29, 1841.

The novelty in the combination of materials consists in the employment of Merstham sand, or pulverised Merstham sandstone, in combination with London clay, pipeclay, or other argillaceous clay, in various proportions, or with the other ingredients usually employed in making bricks, tiles, or pottery. The proportions must be varied according to the quality of article required; but for bricks, two parts, by measure, of Merstham sand and one of clay is said to be a good proportion.

The machinery to be employed for making the before-named articles is described at length, and consists of various contrivances, apparently well adapted for the proposed purposes, and may be briefly described as follows:—The first is a pug-mill internally resembling the ordinary pug-mill, but furnished with an aperture at the bottom, through which the clay is protruded, of the shape of the section of an ordinary brick or tile; the section being taken either lengthways, sideways, or crossways, as may be judged best,

As the prepared composition is forced out of the mill, pieces are cut off, (in some cases rather larger than that of the brick or tile intended to be made,) by means of a knife or wire worked by suitable machinery. As a sufficient quantity of composition is cut off, it is received upon a tray, which carries it forward to the workman, who receives it and places it to dry. Attached to some convenient part of the machinery is a condensing air-pump, which forces a stream of air through four or more jets, which acting upon sand falling before each jet, disperses it round the brick or tile, as it issues from the aperture of the pug-mill.

Another modification of machine for forming bricks or tiles is thus described. A frame or carriage traverses a railway on a suitable bed or foundation, by means of wheels, on the axles of which, and turning with them, is a polished cylinder or roller; a scraper attached to the carriage keeps the cylinder clean, and removes any composition that may adhere to it. Upon the axle of a second set of wheels there is another cylinder, provided with any convenient number of circular knives or cutters, which pass through a box of sand, whereby they are kept clean and charged with sand to prevent adhesion of the composition.

By means of a suspended sieve, sand is also constantly sifted over the surface of the composition as it is spread out on the bed by the first roller. The composition being brought from the pug-mill, may be deposited on the bed by hand, or by wagons traversing the rails, or in any other convenient way, motion being given to the frame or carriage by a rope and drum, or any other mechanical contrivance. The first cylinder passes over the composition, and spreads it evenly upon the bed, being followed by the second cylinder and knives, which cut the composition into strips of the breadth or thickness required for the brick or tile. Two men, one on each side, follow the cylinders or rollers with a frame containing one or more knives or wires, by bringing of which down, and drawing it across the composition, and through notches and openings made for that purpose in the rails upon the bed, the material is cut into the length required for the bricks or tiles. Or the cutters may be actuated by any suitable machinery connecte with the prime mover.

The soft rough-shaped bricks or tiles produced by either of the foregoing processes, are to be well dried, or partially baked, and then passed between various arrangements of circular saws or cutters, which may be used double, so as to cut two sides of the brick or tile at the same time. The bricks so formed and shaped are then to be baked, either in a kiln of the ordinary construction, or of that hereafter described.

For the purpose of compressing bricks or tiles, they are placed on a hard firm bed, over which a carriage containing the pressing apparatus traverses by means of a railway. Upon this carriage two standards support one end of a beam, upon which is suspended a great weight; the other end of the beam is connected with the ram of an hydraulic press. By turning a large wheel the carriage is moved upon the railway, and a man stands upon a platform for giving it this movement, and for working the press. A few strokes of the pump raises the beam, together with the weight, which is then brought over the bricks and tiles previously placed upon the bed. On releasing the water from the press, the weight descends upon the bricks or tiles, compressing them evenly and firmly. A few strokes of the pump then raise the weights, and the carriage is moved on to a further quantity of bricks, &c., until all have been pressed. In lieu of the weight, the direct action of the hydraulic press may be applied to the bricks, if preferred.

The new mode or process of burning bricks, tiles, or pottery, and other useful articles of earthenware, consists in the employment of a circular kiln divided into a number of compartments or ovens communicating with each other, and with a central chimney, by openings which can be closed at pleasure. In the plan shown there are twelve of these compartments or ovens; the apertures between the ovens 1 to 12 are closed, the flues of 1 to 8 are also closed; the aperture between 9 and 10 is also shown as closed. The ovens 1 to 9 are filled with bricks, tiles, potteries, &c.; the fire is kindled in No. 1, and the hot air and smoke pass through all the ovens, one after the other, by the communicating aperture, until they arrive at No. 9, which, having its flues open, and the aperture to No. 10 closed, they pass through the flue into, and up the central chimney. A great economy of heat and fuel will thus be effected, and all the bricks, tiles, or pottery will be burnt equally, and there will be no loss, as in common kilns, from *place bricks*, or *burrs*. The three ovens, Nos. 10, 11, and 12, are cut off from the fire, and while the burned or finished bricks, &c., are being removed from one, new and unburned bricks, &c., are being placed in the second, and fuel is being placed in the third. If a stronger draught is required, a smaller number of kilns are to be used. At proper intervals of time the fire is advanced from one oven to another, and the communication of the series opened or closed, as may be required. The oven of bricks or other articles at the further end of the circle, or that has been longest subject to the action of

the fire, being separated* by the stoppage of the aperture, is then to be emptied, preparatory to receiving a new charge, and so on in succession throughout the whole circle of ovens.

Modifications of this arrangement of kilns are described.

JAMES SIMS, OF REDRUTH, CORNWALL, CIVIL ENGINEER, *for certain improvements in steam-engines.* Enrolment Office, October 29, 1841.

These improvements consist in a new method of constructing and working steam-engines, whereby equal quantities of steam are stated to do a greater amount of duty than has by the like quantities of steam been heretofore performed.

The nature of the invention is illustrated by the application thereof to a single pumping-engine, of the ordinary description used in Cornwall. The cylinder is made of double the usual length, and, instead of being of one uniform bore throughout, it is divided into two parts, the lower half being about four times the area of the upper half. Two pistons are attached to one rod, the one fitting the upper, the other the lower half of the cylinder, and a constant vacuum kept up between them.

Supposing the engine to have completed its up stroke, and that both pistons are at the top of their respective cylinders, with a nearly perfect vacuum between them; the under half of the cylinder is then opened to the condenser, (during the pause which takes place in pumping-engines, between the up and down strokes,) by which a nearly perfect vacuum is also established below the under or larger piston. Steam is then admitted to the top of the small piston, (cutting it off at one-third of the stroke,) and by its pressure there acting against the vacuum underneath each of the pistons, it forces down both to the bottom of their respective cylinders. A valve is now opened, when the partially expanded steam above the smaller piston flows down a pipe to the bottom of the larger half of the cylinder, when expanding to its full extent under the large piston, and aided by the vacuum established as before between the two pistons, (it has also the area of the small piston to act against, which reduces the effective area of the large piston about one-fourth,) it causes both pistons to re-ascend to the tops of their respective cylinders, with a force about equal to that which was exerted in the down stroke. But whereas the force thus exerted in the up stroke is not wanted in the single pumping engine for the mere purpose of raising the pistons, and would, if not counterpoised, act injuriously on the pump-rods, the patentee turns the same to a useful account, by placing on the top of the large piston weights equivalent to about one-half the load lifted by the engine, which weights being raised by the up stroke, diminish in exact proportion thereto the quantity of fresh steam required for the next down stroke. The engine may be worked without these weights, but not so advantageously. The general effect of this improved method of constructing and working the single-acting engine is stated to be, to nearly double the power thereof. In applying these improvements to rotative engines, where equal duty is required of both the up and down strokes, there is no occasion for the addition of any weights to the top of the large piston; and the patentee states that he finds, in practice, that the steam transmitted from the top of the small piston to the bottom of the large one continues of sufficient pressure, in every case, to produce an up stroke of equal force to the down stroke.



NOTES AND NOTICES.

*The Franklin Printing Press.**—The printing-press at which Dr. Benjamin Franklin worked while a journeyman in London, is now exhibiting in Liverpool, previous to its embarkation for America, it having been presented by its late owners, Messrs. Harrild and Sons, of Great Distaff-lane, Friday-street, to the Philosophical Society of Philadelphia, of which Dr. Franklin was the founder and first president.

*Copper Ore.*—The produce of Cornwall for the past three years amounts to £3,110,000, and that of Ireland and Wales to about £170,000, making a total of £3,610,000. In the same interval we had the produce of foreign mines to be £1,746,000, or nearly one-half the amount of the mines of Great Britain. The quantity of copper ore imported within the past seven years, is 158,055 tons, 6 cwt., which, if taken at £15 per ton, would give, say, £2,370,000. The quantity of foreign copper (or such as is assumed to be foreign) exported we find to be 29,920 tons, 14 cwt.: this, taken at £90 per ton, would give £2,700,000 as the value of foreign copper sold in the continental markets, thus proscribing to such extent the admission of the produce of British mines.—*Mining Journal.*

*Errata* in our last Number, page 351, List of Designs Registered, No. 847, for "*strap fastening,*" read "*strap and gaiter fastener.*"

* *Vide ante*, p. 64.

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# Mechanics' Magazine,

## MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 953.] SATURDAY, NOVEMBER 13, 1841. [Price 3*d.*

Edited, Printed and Published by J. C. Robertson, No. 166, Fleet-street.


## WHITE'S PATENT BRICK AND TILE-MAKING MACHINE.

Fig. 1.

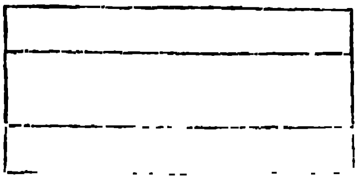


Fig. 2.

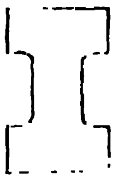


Fig. 4.

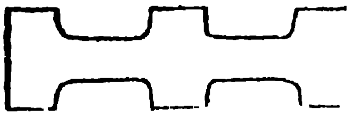


Fig 3

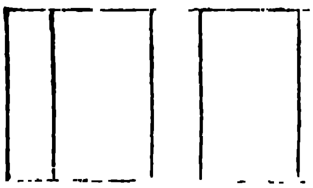
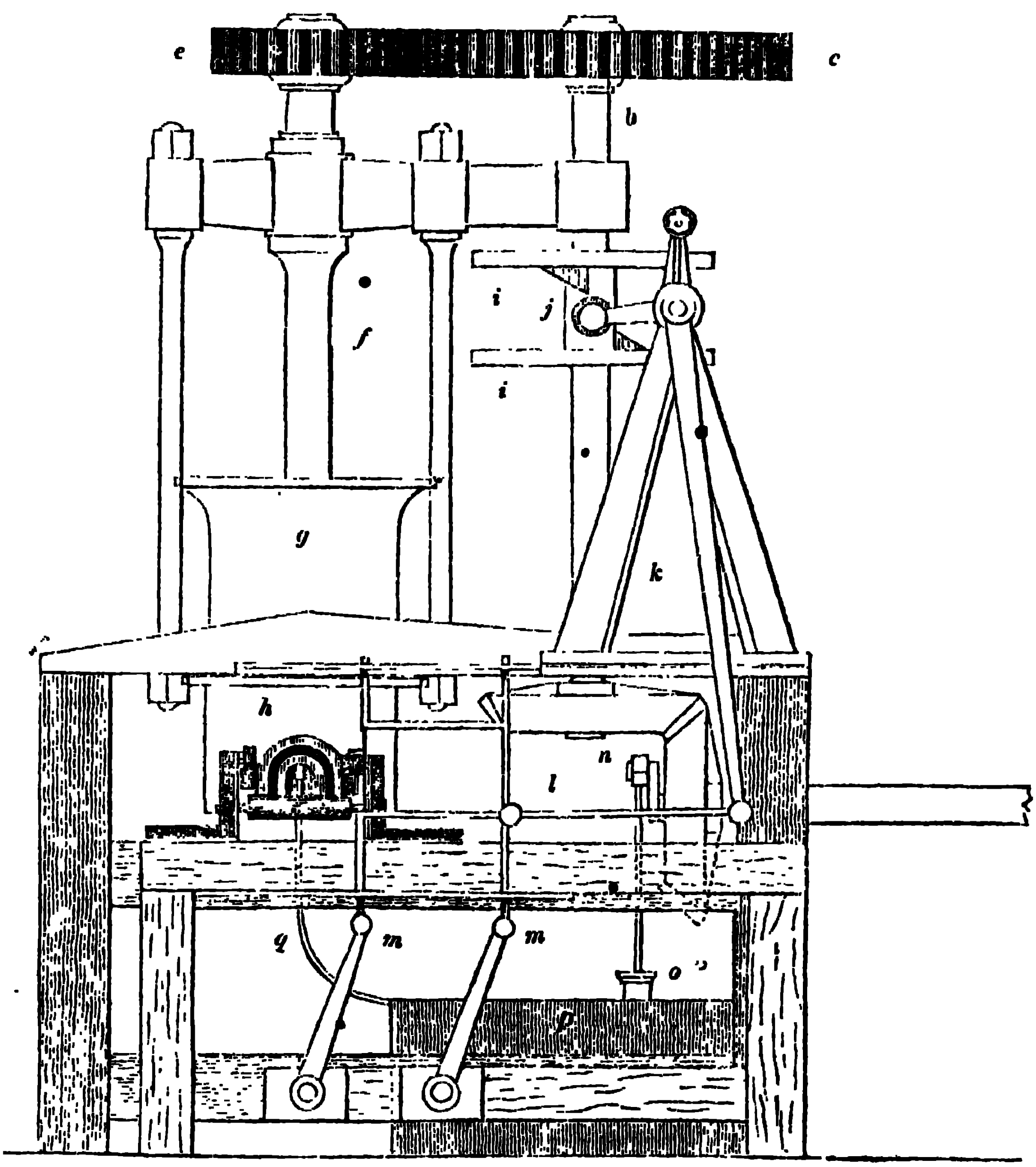


Fig. 5.



## DESCRIPTION OF MR. WHITE'S PATENT BRICK AND TILE-MAKING MACHINE. BY THE INVENTOR.

In the summer of 1839 I was requested to examine a pug-mill at Brixton, then in operation, supplying clay to a brick machine invented by the Marquis of Tweeddale, whose success in drain tile making establishes an early claim to the art of moulding clay for agricultural purposes by machinery. The parties at whose request I attended were licensees of the Tweeddale patent, and the object they had in view, was to be furnished with some plan whereby the pug-mill might produce a continuous stream of clay to the brick machine. The defect in this respect of the Tweeddale apparatus proceeded from the under knives only expelling the clay as they passed the *port*, or aperture where it escaped, which was about 10 inches long, and 6 inches deep; when they were not in a position to effect this, the clay made a stop, the top knives in their turn being too distant to produce a similar result. At these intervals, with the brick machine in motion, the clay parted, and the bricks at such places were generally spoiled. To remedy this evil, I proposed making each knife a regular segment of a circle, and fixing them at the bottom of the pug-mill on a round shaft, with iron collars between them, so that the edge of the one segment should begin its evolution where the former left off, and a uniform pressure on the clay be thus kept up as the shaft revolved. But this arrangement, both in principle, and form, approached the screw so closely, that it was almost immediately abandoned for the latter. With the screw as a propelling instrument, I next proposed converting the pug-mill into a brick machine, by contracting the aperture the clay escapes from, to the form and size transversely of a brick, and giving the screw sufficient power to expel the clay through it. At this proposition the licensees of the Tweeddale patent got alarmed, supposing if bricks were so formed, draining tiles might also be protruded through a suitable orifice, and to protect their own interests, they entered into arrangements, in pursuance of which a patent was obtained for my invention in the following autumn.

I have explained these facts, from observing in a late number of the *Mechanics' Magazine*, an extract from an English specification enrolled last September for a machine on the same principle, namely, *forcing clay through moulding apertures by pressure from the inclined surfaces of a screw*. It is true, that in the invention alluded to, the arrangement is different from mine, but the screw and moulding orifice are employed, which no person has a right to use in England without my consent.

Bricks which are moulded by pressure, either by the Tweeddale apparatus, or by my screw machine, must of necessity have more solidity than bricks formed by hand--and this is a property which builders are not likely to appreciate from its adding weight to its bulk, and consequently increasing the expense of conveyance; from being heavier to handle too, they may also possibly add to the charge in building. I have considered this subject well, and recommend machine-made bricks to be moulded of the form represented in fig. 1, and fig. 2, the latter of which is an end view. Bricks of this form are well adapted to partitions, and all sorts of building intended to be plastered over. The quantity of clay removed by the grooves *a a*, would reduce their weight to that of common bricks, and give additional facility to drying and burning them. For ornamental cottages, a brick of the form of fig. 3, might be used as a binder; fig. 4 is a side view of it. Bricks of this form would be bedded so close, as to leave the joints hardly perceptible, the mortar being retained in the recesses, the work would be stronger than usual; and from the solidity of the bricks, impervious to water, which is not the case with hand-made bricks, although of the very best description. In cases of cottage building, where design is unfettered by the close grip of economy, pipe clay might be introduced in forming the bricks, and give to them a new and elegant appearance.

I shall now proceed to describe the machine.

Fig. 5, *a*, is a driving shaft; *b*, vertical shaft in gear with the former, by two bevelled wheels; *c*, spur-wheel; *e*, large pinion on the shaft, *f*; on the

lower end of this shaft a screw of one turn is formed, and fitted to the cylinder *g*, in which it revolves; *h*, cylindrical chamber into which the clay is pressed by the inclined surfaces of the screw on the shaft, *f*, and out of which it exudes at the moulding aperture, represented by a curved dark line in form of a draining tile. The clay is supplied at the top of the cylinder, *g*, by engine power, or manual labour, as circumstances may determine. The cutting apparatus receives motion from two inclined planes on the circular plates, *ii*. As the plates revolve, the inclined planes alternately strike the roller, *j*, on the upper and under side; when the roller is depressed, the lever *k* is moved to the right, and when it is raised it is moved to the left. The cutting frame is attached to the lever, *k*, by a connecting rod, *l*, and supported from four levers, two of which are only seen, marked *m m*. There are also two cutting wires, to divide the clay as it exudes from the moulding orifice, one of which is only seen, represented by a sharp dark line near the orifice. The cutting wires are the exact distance apart from each other, required by the length of the moulded articles, and for each revolution of the screw, a sufficient quantity of clay is moulded to make two, (and a little more,) one on each side of the machine, its operation being double, the overplus falls down, and is thrown back and re-moulded. The object of cutting with two wires is to produce all the articles of the same length. When the shaft *b* makes ten revolutions per minute, the shaft, *f*, makes twenty, consequently, forty bricks or tiles are moulded in the same time. The cutting wires and frame have a sawing motion, from being sustained on the levers, *m m*, which is preferable to moving them in a straight line. As the articles are cut they are removed by hand, or conveyed away on an endless belt supported on rollers, one of which is seen below the moulding orifice, and one at each side for lateral protection. In moulding tiles from an orifice, the edges are slightly turned up, which prevents the tiles from slipping after they are laid, an accident of frequent occurrence, and not unfrequently accompanied with a complete destruction to the drain.

On the end of the driving shaft, *a*, a small crank, *n*, is fixed, which works the force-pump, *o*, in the cistern, *p*; this pump supplies water to the moulding orifice by a small pipe, *q*, and within the cistern there is a cock to regulate the supply. The orifice being lubricated in this way, the movement of the clay through it is made easy, and whatever be the figure of the mould, the clay exudes with a smooth unbroken surface. In moulding draining tiles, the clay is cut in motion, the small angle thereby produced being of no consequence, but when the articles require to be cut at right angles, the clay stops at that moment, by a contrivance added to the wheel *c*, for that purpose.

JAMES WHITE.

11, East-place, Lambeth, October, 1841.

## MR. PARKES' THEORY OF THE PERCUSSIVE FORCE OF STEAM.

Sir,—I have to-day read the paper, (From the Minutes of the Transactions of Civil Engineers,) contained in No. 946, page 247 of your very useful work, "On the Percussive Action of Steam, and other Aeriform Fluids." By Josiah Parkes, M. Inst. C. E., in which, illustrative practical proofs are furnished of the percussive effect of steam upon the piston of the steam engine, as a motive power, and that the impulse furnished is due to percussive power rather than to expansive, but without any attempt to elucidate the theory of such force. As the effects described appear to me to corroborate very strongly the theory which I have, from time to time, endeavoured to inculcate in your pages relative to the law of equal diffusion to which heat is subject, I cannot refrain from attempting (with your permission) to point out, what appears to me to be the theory of the percussive power of steam, as well as its expansive.

It will perhaps be remembered by some of your readers, that in a former communication I pointed out, that not only is heat subject to the law of equal diffusion, but that the rapidity of its diffusion is in the reverse ratio to the difference in the thermometric temperature of the impartive and receptive substances, and that, therefore, the greater that difference the more rapid

will be the transition of heat, and the greater its repelling or impulsive force. It will also probably be remembered that I expressed the opinion, that the thermometric temperature of steam cannot be increased beyond 212°, and that the superior impulsive power of high-pressure steam above that of low pressure, is due to the accumulation of heat in the metal composing the boiler, instead of to its accumulation in the steam within the boiler, and that the immense power exerted by such steam on its egress from the boiler is not innate in the steam while within the boiler, but is derived from the thermometric heat of the metal of the boiler in which it is accumulated, and from which it is rapidly transmitted to the water in the boiler—creating additional volumes of steam, on the opening of the eduction valve, as induced by the law of equal diffusion, and thereby imparting to such steam both its percussive and expansive power, the former in the inverse ratio of the difference between the amount of accumulated thermometric heat in the steam within the boiler, and the metal of which the boiler is composed.

To illustrate more clearly the principles of the theory which I advocate, I will first suppose, that thermometric heat is imparted to water in a boiler, until the temperature of both is raised to 212°, and if the valve communicating with the cylinder of the engine is opened as suddenly as possible, it will be found that such steam does not possess a sufficient percussive power to raise the piston, and the effect will be, that as much heat will be abstracted from the steam emitted, by the metal of the cylinder and piston, as will reduce the temperature of the one, and raise the temperature of the other to a state of equality; and such a reduction in the temperature of the steam will cause its condensation, or, in other words, will cause its component ponderable atoms to unite and be reconverted into water. But should the piston in such cylinder be raised by adventitious means, the moment the steam valve leading to the cylinder is opened, the steam will enter, and although not of sufficient volume to fill the cylinder in its natural state, yet will it expand and fill the space for a short period, as induced by the law of equal diffusion, to which the heat of the steam is subject, and such steam being decomposed by the removal of its caloric beyond its constituent limits, its ponderable atoms will be released from their component position, and fall to the bottom of the cylinder as induced by the law of gravity.

As the generation of steam, under such circumstances, will not furnish a sufficient motive power, it becomes necessary to resort to those means which are adequate to the purpose, and the *rationale* of such means appears to me as follows:—

The safety-valve of the boiler is loaded to an amount more than equal to the intensity of the force required to raise the piston of the steam cylinder, in order to prevent the escape of the steam within the boiler; and the moment the space above the water is completely filled with the indestructible and incompressible constituent atoms of steam, it becomes impossible that more can enter, other than to supply the place of those atoms of heat which permeate the metal of the boiler, and escape by radiation. At the time such space is filled, the thermometric temperature of the steam within is about 212°, and no subsequent addition of heat, or further retention of such steam within the boiler, will ever cause an increase of its thermometric temperature. Now having endeavoured to show that steam of such a temperature does not possess sufficient power to raise the piston within the cylinder, it next devolves on me to attempt to show what additional power is required to effect the purpose—whence that power is derived—where collected—and the way in which it is applied.

The source from which the power is derived, is the fuel in a state of combustion in the furnace; the magazine in which it is stored is the metal of which the boiler is constructed; and the mode of application is by the law of equal diffusion to which heat is subject.

The transmission of heat from the burning fuel to the boiler, and from the boiler to the lower stratum of water therein, is induced by the law of equal diffusion; and from the lower to the upper surface by the same law in the first instance, but subsequently by the

secondary law of recession from the earth; the thermometric temperature of the upper surface ever exceeding that of the lower, until the whole mass is raised to about 212°.

The impartation of heat being continued, its atoms are transmitted from the lower to the upper surface, and every interstice furnished by the position of the spherical ponderable atoms of the water being completely filled, a definite and proportionate amount of such ponderable atoms are raised from the mass of water in combination with a definite and proportionate amount of the atoms of heat—the admixture constituting the fluid termed steam, which gradually expels the air from the space between the water and the dome of the boiler, and occupies its place, remaining there until mechanically released, or until the accumulated power resulting from the continued impartation of heat, exceeds the restraining power, and the raising of the safety-valve or the disruption of the boiler, and the liberation of the imprisoned steam ensues.

The whole of the interior of the boiler, being completely filled with solid and incompressible atoms, and the interstices presented by the union of the ponderable atoms being filled to repletion with the atoms of heat, and the thermometric temperature of the whole mass being about 212°, I have yet to learn how it is possible, that the density of the steam within the boiler, or its thermometric temperature, can be increased by the continued impartation of heat, or in other words, how the atoms of such additional heat can find access to, that which I conceive to be, a perfect plenum, except as to the interstices which must be presented by the union of the atoms of heat. In short, unless any one is prepared to prove the existence of a more subtle fluid than heat—that the atoms of such fluid are smaller than the atoms of heat,—and that their introduction can raise the thermometric temperature of the steam within the boiler,—I must ever remain sceptical as to the possibility of compressing a volume of steam into a space less than that which it naturally occupies at a temperature of 212°, or to increase the thermometric temperature assigned to it. I am finally, therefore, constrained to reject the commonly-received notion, that the force of steam is due to an increase of its density, or thermometric temperature.

As little can I assent to the alleged elasticity of steam. For if, then, the limits of the receptive capacity of the water for heat, and the steam within the boiler is such as will admit of no greater increase of its thermometric temperature than to the extent of 212°; if steam is composed of a large amount of the atoms of heat, and a small amount of the ponderable atoms of water;—if those atoms of heat in their passage through water, are enabled to raise from its surface those ponderable atoms which were closely or proximately united, with a force superior to the power of gravity, and to place them widely distant in position, as a necessary condition to the formation of a fluid of much less specific gravity than the water from whence derived;—if there is no contradiction in the laws of nature, and the impartation of heat to water decreases its density as a liquid, and infinitely decreases its density as vapour;—if there exists no such anomalous contradiction in the execution of those laws, as that a moderate impartation of heat is absolutely necessary to expand water and steam, and decrease their density, and that an excessive impartation is necessary to compress and increase their density, then steam cannot be elastic, nor can it possess any innate motive power.

What then is this stupendous power? Equal diffusion of heat, subject to a celerity of transmission in the inverse ratio of the difference in the thermometric temperature of the impartive and receptive substances. And where is its source at the time of action? In the metal of which the boiler is constructed, which becomes a receptive magazine for the imparted heat which emanates from the burning fuel, and which (the steam not being able to receive beyond its constituent limits,) is therein stored to any extent within the limits of its receptive capacity, or cohesive tenacity, ready to obey the law of equal diffusion to which it is subject, with a force and rapidity of transmission, proportionate to the ratio of difference between the amount of atoms therein collected, and which may be possessed by the receptive sub-

stance. And by what mode of action is that force exerted? The moment the steam induction valve of the cylinder is opened; as much steam as will fill the pipe communicating with the cylinder and the vacant space beneath its piston, will leave the boiler, and the vacated space will be filled with fresh created steam, volume after volume rushing into the cylinder, impelling the fleeting piston before it with a rapidity proportionate to the difference in the thermometric temperature of the cylinder and piston, and the metal of which the boiler is constructed. The more promptly the induction valve is opened, the greater will be the percussive force upon the piston, inasmuch as both cylinder and piston possessing a receptive and radiating capacity for caloric, and thereby diminishing the momentive force of the steam by an abstraction of a portion of its motive power (caloric), so the more rapid the impact of the steam with the piston, the less must be the abstraction and consequent diminution of that power.

The expansion of steam within the cylinder on the rise or depression of the piston, causing it to occupy a greater space than its natural volume, I conceive, is also due to the law of equal diffusion, to which heat is subject; for agreeably to the theory which in a former communication I endeavoured to advocate, that no real vacuum can possibly be created, inasmuch as although it may be effected so far as relates to the presence of the ponderable atoms of matter, yet such vacated space will be filled with the imponderable atoms of latent heat, so therefore will the constituent heat of steam expand beyond its natural limits to occupy the vacated space resulting from the rise or fall of the piston within the cylinder, the heat of such steam being more suitably posited and circumstanced to yield a prompt obedince to such law, than the heat which the surrounding media can furnish. Agreeably to this view, the modern system of supplying the cylinder with (what is termed) high-pressure steam, to an amount insufficient to fill the cylinder on the recession of the piston to its utmost limits, at its natural density, appears to me to be admirably adapted to effect its economical appropriation, inasmuch as high percussive power is applied to the piston to cause the commencement and continuance of its motion, and that motion being accelerated and extended by the momentum derived from the sudden impact, beyond the bounds to which the initial force of the steam would carry it, the subsequent expansion of that steam to fill the vacated space resulting from the speed exceeding the gradually diminished force by which the piston is impelled, supplies an additional and sufficient force to carry the piston home, resulting from the further impact of that steam, impelled to motion by the law of equal diffusion to fill up a space, which, without such law would prove to be a vacuum.

If these theoretical views are correct, the following practical deductions may, I think, be usefully drawn therefrom.

1. That the thicker the metal of the boiler, not only the greater will be its strength, but the greater will be its accumulative capacity for heat, and consequently the greater will be the power furnished through its medium.

2. That the better the boiler is clothed, the less will be the loss of its accumulated heat by radiation, and consequently, the less will be the loss of power generated.

3. That the thicker the cylinder, and the better it is clothed, the less will be its heat transmissive capabilities, and consequently its receptive, and therefore the less its abstractive effect from the power of the steam which enters its interior.

4. And that the greater the density of the metal of which the cylinder and piston is composed, and the higher its internal and external polish, the less will be its receptive capacity for heat, and consequent abstractive effect upon its percussive power.

Trusting and hoping that this essay may provoke an abler pen to endeavour to do more ample justice to the subject,

I remain, Sir,

Your obedient Servant,

G. A. WIGNEY.

Brighton, October 31. 1841.

## THE "STYX" STEAM FRIGATE.

The *Hampshire Telegraph* of Saturday last, mentions that the *Styx*, which recently sailed for Canada with the new Governor, Sir Charles Bagot and suite on board, had been compelled to put back to Portsmouth "in consequence of having broken the connecting rod of her engine, and sustained other damage during the late gales." The accident to the machinery, it is added, "was occasioned by *the attempt* to bring into operation the invention of Messrs. Seaward, whereby one wheel may be disconnected from the other wheel; in this *attempt* the connecting rod was broken." Such a statement can proceed only from entire ignorance of the nature and history of the invention in question, or, what is worse, from a malicious design to cast discredit by gross misrepresentation on a most ingenious and useful contrivance. By the phrase "*attempt* to bring into operation," it is evidently meant to be insinuated that this was the first time the disconnecting plan of Messrs. Seaward had ever been tried; but so far is this from being true, that before the government wisely resolved on adopting it, it had been used with uniform and unfailing success on board of the *Vernon* and *Hardwicke* East Indiamen, during two voyages to India and back. We are further given to understand by the writer, that this "*attempt* to bring into operation" Messrs. Seawards' plan for disconnecting the paddle-wheels from the engines, was the immediate cause of the breaking of the connecting-rod of the engines; although, in truth, the one has no more necessary relation to the other than the boatswain's whistle has with the vane at the mast-head. From an account of the true causes of the accident which has been since given by the *Times*, it appears, that though the engine connecting-rod was indeed broken, and by means, too, of a disconnected paddle-wheel, this did not take place, as alleged, "*in the attempt*" to disconnect the wheel, but occurred subsequently from a failure in the lashings by which the disconnected wheel should have been kept motionless. It appears, besides, from this account, that the plan of disconnection was had recourse to, in this instance, most foolishly and mischievously; for though disconnecting one wheel may be of great use when a ship is tacking, or wearing, (the operation being analogous to that of a rower making use of one oar only,) or disconnecting both may be equally so when it is desired to take instant advantage of a favourable wind, without waiting till all the steam machinery is brought to a stand, nothing more mechanically absurd can well be imagined than the course which the engineers of the *Styx* are stated to have adopted, of running before a strong gale with the whole power of the engines applied to one wheel.

The following is the account to which we have alluded, as given by the *Times*: "When the *Styx* left Cork she was most heavily laden with stores and baggage of all descriptions, and was unusually deep in the water; off Cape Clear she encountered a tremendous sea, which swept the decks, and the engineer, believing that one wheel had been much damaged by the shock, bethought himself of disengaging that wheel, and working the full power of the engines upon the other, (for this purpose the apparatus was never designed;) however, the wheel was quickly disengaged, and lashed fast by chains, and the full power of both engines put upon one wheel. As the ship fetched way through the water, there consequently became a great strain upon the stationary wheel, and upon another sea striking this wheel a heavy blow, it broke loose from the chains by which it was held, and turned round of itself, when the crank upon the shaft of this same wheel, coming in contact with the connecting-rod of the engine then at work, broke the latter short off, although made of wrought iron, and of 8 inches diameter; no other part of the machinery was the least injured.

"The whole cause, therefore, of the accident may be attributed to the want of foresight in the first engineer in attempting to work his engines while the wheel was disengaged · unfortunately, the second and third engineers were laid up sick at the time, nor had the captain or any of his officers ever been to sea in a steamer before, so that the

first engineer was dependent on his own resources."

We understand that the first engineer, whose "own resources" were thus miserably deficient, has been since discharged, and another appointed in his place. The necessary reparations of the *Styx* were completed on the night of Friday the 5th inst. and on Saturday morning she steamed round the Isle of Wight, deep as she was, at the rate of ten and a half knots per hour, and was pronounced once more in a fit state to proceed on her voyage.

## FRANKS'S MECHANICAL HORSE.

Fig. 1.

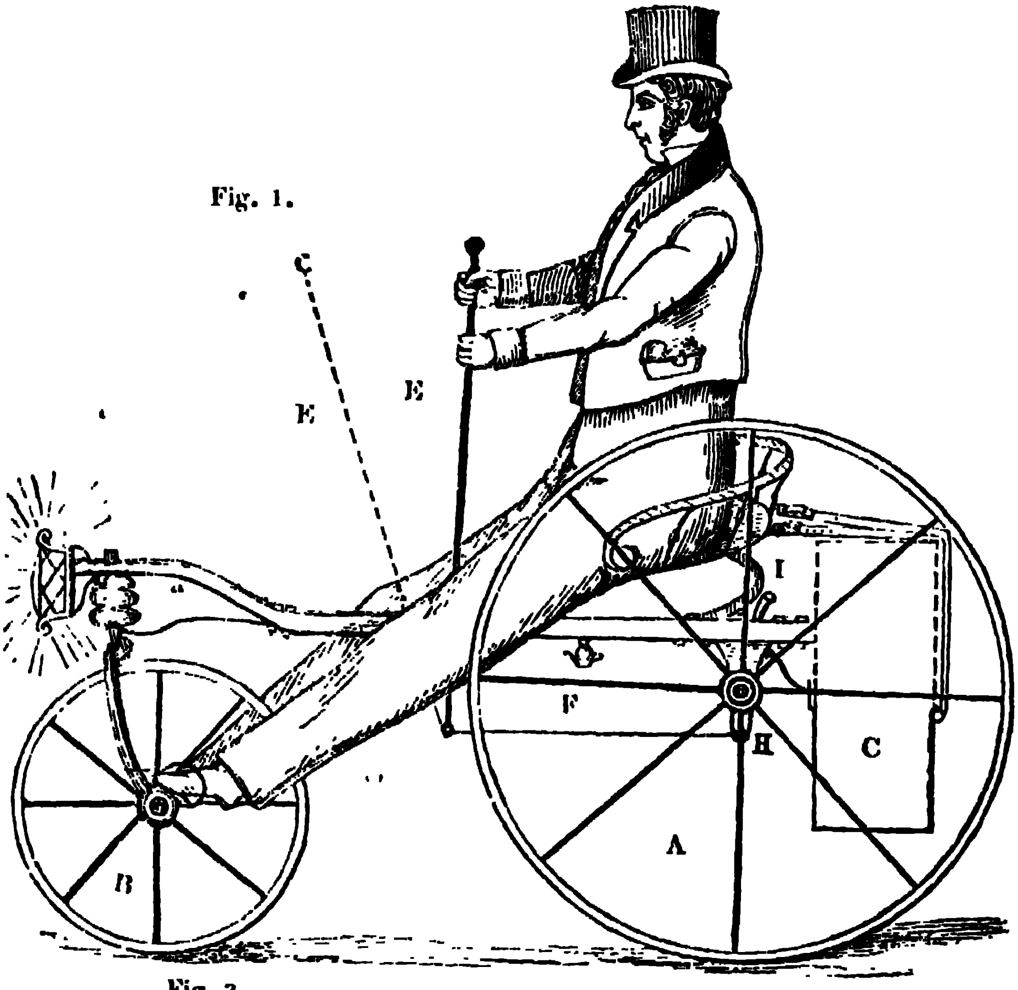



Fig. 3.

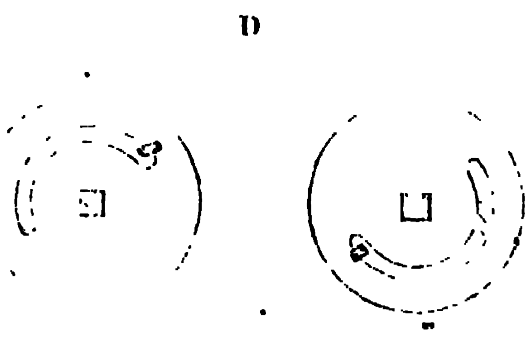
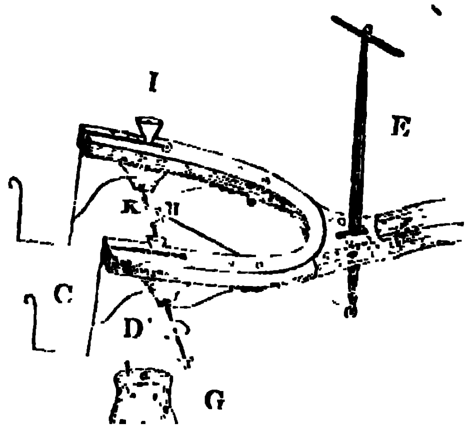



Fig. 2.




Sir,—Finding your useful columns are always open for anything curious and interesting in mechanism, I herewith forward you as near a sketch as I can possibly execute of my "Mechanical Horse." Being a traveller, of

course I require some assistance in transferring me and my goods from one town to another, and finding to my cost, that a horse of flesh and blood, needed the needful to keep him a. jogging, thirteen months ago I constructed a horse, composed of stout wood, tough iron, and bold brass. From that time until now, I have travelled with it on an average of ten miles per day; certainly, at first my arms tired, but constant use overcame that, on the same principle as the smith wields the massive sledge hammer, (practice)—and I will assure you, my chest is 4 inches more across, and the muscles of my arms 2 inches round, *more* than they were twelve months since. In fact, I find that it is as easy to propel myself and 1 cwt. of luggage at six miles an hour, as it is to walk three in the same time—and when fortunate enough to get my luggage forwarded, why I can spin along at a speed that a crack trotter would find his task set to keep up with me. The greatest speed I have attained was 16 miles in one hour and a half, from Newton Abbot to Exeter; the distance is reckoned 15 miles, but you will remember the Devonshire miles are *long and narrow*; this was accomplished on the 17th of July, 1841. It has been said by one of your correspondents, that these sort of vehicles can never be made so as to be really useful: I fancy my machine *is*, at *all events*, useful to me. I well know, that I should be at a sore loss without my hobby, and to prove what I have stated, I will make a wager of not more than 30*l*., that I will travel with my "Mechanical Horse" forty miles per day for six successive days. After having travelled with it one year, I can speak conscientiously as to its merits.

If you think this communication will be in any way interesting to your readers, it is at your service to make what use you please of it.

I am, dear Sir, yours obediently,

L. Franks,
Optician.

Hitchin, Herts, November 6, 1841.

### *Description of engravings.*

A, fig. 1, two 3-foot wheels.

B, guide-wheel, 18 inches in diameter.

C, luggage-box, (movable.)

D, fig. 3, two mortise plates brazed on the crank's axle, reverse to each other, allowing each wheel to make a half turn for passing round corners in the road.

EE, a lever, 2 feet from fulcrum, showing its sweep.

F, connecting rod.

G, Fig. 2. nave of the wheel with a dog-stop (fixed firmly in) to work in the mortise-plate.

H, a 3-inch crank.

I, two oil feeders.

K, the crank axle, 2 feet 6 inches long, made round, to run in nave; the latches in the mortises turn the wheels.

Fig. 2 shows a portion of the horse-piece.

The whole of the bearings are bell-metal; those in the crank axle are ¼ inch.

### THE SHANNON NAVIGATION—MR. WATSON'S DOUBLE CANAL BOAT AND MR. RENNIE'S TRAPEZIUM PADDLE WHEELS.

*Saunders's* (Dublin) *News Letter* of Monday last, contains a long and interesting account of the successful introduction of steam navigation on the Shannon, between Limerick and Killaloe, the only part of that noble river which (owing to great natural difficulties) has remained hitherto unsubdued by steam's "all conquering power." We must defer till next week the transference of this letter in full to our pages; but may mention in the meanwhile, that this important triumph has been effected by the adoption of Mr. Watson's Double Canal Boat, described in our 32nd vol., p. 209, and of Mr. George Rennie's Trapezium Paddle-wheels (slightly modified), which we have so often had occasion to bring under the notice of our readers (see particularly, vol. 32, p. 536, and vol. 33, p. 19, where mention is made of their having been fitted to the Government steamer *African*). The engines used were designed and built by Messrs. John and Robert Mallet, of Dublin, and are much praised for combining lightness with strength. "At 6 miles per hour," the vessel is said to "produce scarcely any wave of translation, and no surge is produced by the paddle-wheels capable of injuring canal banks."

IMPORTANCE OF UNIFORMITY OF SIZE AND SHAPE IN ARTICLES COMMON TO DIFFERENT MACHINES AND INSTRUMENTS.

Sir,—I have read with much pleasure an article in No. 951, on the threads of screws and screw-bolts.

It would be a work of supererogation for me to presume to remark on so able a paper, but I cannot resist the temptation to mention a somewhat analogous system of uniformity of screws, threads, and other constant pieces in the construction of all French and Italian artillery and fire-arms; that is to say, every screw and nut, and other parts, are made according to an exact standard, so that any piece out of half a million may be fitted by screw, or bolt, or nut of any one of the others. The same holds good with locks, clasps, (tennons,) triggers, &c., &c.

Although not quite bearing on the paper of your intelligent correspondent "J. W.," I take this opportunity to repeat that which I have dinged and dinged into the ears of our routine ordnance authorities in various works, as also in the pages of your *too good* miscellany; that is, that the calibres of all arms should be exactly similar. The French have the same sized ball for the muskets, cavalry carbines, and pistols for land or sea service, so that the same cartridges will fit them all. To adapt a musket cartridge for a pistol, it is only necessary to bite it and cast away half the powder.

Again, on board ships of war, what, in the name of common sense, can be the object in having guns, and shot or shells of different calibres? Only confusion. It may be as well to have *lighter* guns on the upper parts of the hips, but still they may be of the same calibre as those of the lower ones, only lighter in metal, *i. e.* such as we call carronades, so that every shot, or grape, or shell on board shall be all exactly of the same calibre.

From the year 1791 the British adopted the use of carronades on the quarter-decks, poops, &c., of their ships, with great and manifest advantage, whilst the French continue to use their trumpery four, six, and eight pounder long guns on such localities. Such, however, is the blind prejudice of routine.

People must be beaten into self-defence, as they will be by my prehensile rockets, and shot-proof steam-ships, which I offered to the Duke of Clarence in 1827. But as I cannot now write a volume, I must end by declaring myself, Sir, Your obedient servant,

F. MACERONI.

November 3, 1841.

ON THE FORMATION OF EMBANKMENTS AND THE FILLING-IN BEHIND RETAINING WALLS. BY JOHN B. HARTLEY, M. INST. C. E.

[From Trans. of Soc. of Civil Engineers.]

The numerous failures of the embankments in the construction of railways, and the constant occurrence of defects in retaining walls, induced the author to offer some remarks upon the subject.

He first examines the ordinary mode of commencing the embankment at the contemplated finished level, and proceeding with the work at that height throughout, leaving the material to find its own inclination; forming the required slopes on the sides when the filling is completed. This, he contends, (although without doubt the most rapid mode of proceeding,) is defective in principle, for the material as it is deposited forms layers or strata at such an inclination as its nature permits, and always has a tendency to slide in the direction of the slope. In such cases, as the centre sinks, the sides slide away, and, having nothing at the feet to resist such a tendency, they are carried out to a dangerous extent. This is particularly the case with clay embankments, for the material is generally brought from the cuttings in large lumps, which cannot be consolidated as they are deposited: the water lodges in the interstices, keeping the bottom soft; and when it begins to subside it slides away, until it has formed itself into a slope, at which it can resist the pressure.

To prevent this sliding, the author recommends proper footings being prepared for the sides of the embankments by cutting trenches, about 4 feet 6 inches deep, along the bottom line of each slope, and forming a "cop" of sods or of stones, placed at right angles to the line of the slopes. These footings must be of a strength proportioned to the height of the embankment, and the whole length should be completed before the filling is commenced, that they may have become solid, and the sods have grown together, before the weight is brought upon them.

He advises, also, that instead of carrying on the filling in one lift, two embankments should be made, varying in height from 15 feet to 20 feet, according to the nature of the

material, wide enough for two earth waggons on the top; one of them running along each side of the site of the contemplated embankment: a valley would thus be left in the centre, at the junction of the two inner slopes. When they have been carried along the whole length, or to such a distance as would insure their being considerably in advance the second or the final lift may follow. With clay or soft materials, four low lifts following each other would be advisable; with these precautions, slips of the embankments would be of rare occurrence. The bottom would become solid by the passing of the weight over it, and the succeeding lift being thrown into the centre valley, must settle vertically. The subsidence, which is always in the line of inclination, would be concentrated and thrown inwards; by these means the width of the slopes would be restricted, and the work would be constructed much cheaper, there being a saving of both land and labour. Land springs, which are usually only discovered by the pressure of the weight above, would be more easily reached with the low lifts than when covered by the heavy ones.

This mode of construction has been practised by Mr. Jesse Hartley on the Manchester and Bolton Railway, where the embankments were very heavy, and the material of the worst description; yet the work was executed in a most satisfactory manner, and the cost of the maintenance of way upon that line is quoted as being less in proportion than on any other railway in the kingdom.

This method may require more time, and be a little more expensive, but the author is of opinion that the trifling difference in time and cost would be amply repaid by the freedom from expense when the road was opened.

The author then examines the subject of retaining walls. He considers the method of filling towards the wall from the natural bank behind, to be highly objectionable; the material lies in strata at the angle at which the deposit is made: as the quantity increases the subsidence commences, and the earth slides downwards, throwing its whole weight against the back of the wall. The tendency to slide is frequently accelerated by the natural form of the ground upon which the earth is thrown, as it not unfrequently inclines towards the wall, in which case the pressure will necessarily be in proportion to the inclination of the slope, and the nature of th material of which the filling is composed. The wall at Hunt's Bank, on the river Irwell, is instanced as a failure of this description. The wall, about 100 feet in length, and 20 feet in height, 5 feet thick at the bottom, and 3 feet 6 inches at the top, built of ashlar masonry strengthened by counterforts, was forced into the stream by the pressure of the earth behind it.

With proper attention to the manner of filling the different materials, a comparatively slight wall may be constructed to sustain a considerable weight of backing. The author lays down as a rule that, wherever it is practicable, all filling behind walls should be commenced at the wall, and be proceeded with from thence towards the solid ground, by which means the strata would be inclined in a similar direction; ledges or benches, either level, or inclined in an opposite direction to that of the bank, should be cut in the solid ground to receive the filling, and counteract its tendency to slide. The weight should not be laid too quickly upon a new wall, and if with these precautions care be taken that the counterforts are constructed simultaneously with, and well tied into, the wall, a comparatively weak structure will bear a heavy mass of filling.

The author gives as an example the retaining wall constructed on the west side of Jackson's dam, near the Brunswick Graving Docks, Liverpool. This wall, although built of slight dimensions, and filled with material of the worst description, resisted perfectly all strain; this could only be attributed to the filling having been gradually done in the manner which the author's practice leads him so strongly to recommend.

This communication was accompanied by diagrams descriptive of the mode of constructing embankments.

### DESCRIPTION OF THE GREAT AQUEDUCT AT LISBON, OVER THE VALLEY OF ALCANTRA. BY SAMUEL CLEGG, JUN.

[From Trans. of Soc. of Civil Engineers.]

This aqueduct was founded by king John the Fifth, in 1713, and completed by the Marquis of Pombal, 1755. It resisted uninjured the shocks of the great earthquake in that year, although it was observed to oscillate considerably.

The most conspicuous part of the work is that which crosses the Valley of Alcantra; it consists of thirty-two arches, with spans varying from 50 to 105 feet; the crown of the centre arch is 225 feet from the ground. The length of this portion is 3,000 feet.

The sources from which the supply of water is derived are situated in the high ground in the neighbourhoods of Cintra and of Bellas—they are eighteen in number; one of these tributaries is conveyed by a culvert from a distance of fifteen miles.

The main duct into which the tributary streams empty themselves forms a tunnel of 6 feet wide, and 7 feet high, ventilated by

vertical shafts, at distances of a quarter of a mile apart.

The channels for the water are made with "drain tiles," 12 inches wide and 9 inches deep, open at the top.

After passing over the great aqueduct, the main duct runs under ground for half a mile, is carried across the "Estrada do arco Cavalho," on seven arches of 40 feet span each, on the south side of which it continues beneath the surface until it reaches the aqueduct of "Agua Livres," in Lisbon, and empties itself into the reservoir at its termination.

This reservoir is 60 feet long, by 54 feet wide and 27 feet deep. The quantity of water contained in it when the author took the measurements was 64,800 cubic feet. He was unable to obtain a section of the retaining walls, but supposed them to be about 23 feet in thickness.

The pipes through which the water is distributed to the neighbouring fountains are of earthenware and stone set in mortar. The velocity of its flow through the main duct is 75 feet per minute. The quantity discharged is about 73,000 gallons in twenty-four hours, during the winter months.

The particulars relating to the construction of the aqueduct the author translated from the documents preserved at the office of Public Works in Lisbon.

The foundations were laid in May, 1713, and the piers, which in common with the rest of the work are of grey marble, carried up without footings. They are faced with ashlar work, in courses from 1 foot 6 inches to 2 feet deep. The stones are dowelled together with bronze and iron; the centre portion of each pier is filled in with rubble masonry to within 30 feet of the top, above which it is left hollow.

The voussoirs of the principal arch, to which the author more particularly refers, are carefully jointed, their thickness being on an average 8 feet at the springing, and 5 feet on the square at the crown.

The figure of the arches is pointed Gothic, the rise being $\frac{7}{10}$ths of the span.

The spandrels are of closely jointed ashlar work, about 2 feet 6 inches in thickness.

The backings are filled in with rubble quite solid; nor is there any provision made for the drainage.

The mortar used was made with lime from the grey marble of the neighbourhood, and sharp *sea sand*, in the proportions of one of the former to four of the latter.

No mechanical contrivances were used for hoisting the blocks of marble, but they were slung upon poles from men's shoulders, and carried up a series of inclined planes to the height required.

Some of these blocks weighed upwards of three tons.

The scaffolding and inclined planes erected round the piers were of a very substantial description.

The lower parts were trussed framings formed of double Riga or Dantzic timbers 15 inches square, fastened together with trenails of teak and chestnut. The inclined planes had a rise of about 1 foot in 6 feet, with a level space at each end of the pier to serve as a resting place, where a separate gang of men received the stone block, and relieved the others.

The ends of the upright timbers of the scaffolding were not suffered to be surrounded by earth or moisture, but were placed upon blocks of stone bedded firmly and evenly upon the rock, and kept well tarred. The struts and braces retaining them were also secured from decay in the same manner. These precautions were necessary, not only from the great weight they had to support, but from the length of time they remained in use—not less, it is supposed, than thirty years.

The centring for the arches was constructed by an Italian architect named Antonio Davila.

The arches were commenced from each side of the valley at the same time, and a temporary gangway erected over them as they proceeded, so that the inconvenience of raising the material from the bed of the valley was avoided.

The centrings were framed in their places. The cradles which supported the bearing timbers of the lower truss were morticed into sleepers resting upon projecting stones left for the purpose; those on the same pier were secured by cross timbers so as to balance each other. The lower framings were first fixed and secured by straining pieces, and the upper portion erected afterwards in the manner of a roof principal. All the scarfs were cut vertically, fastened by trenails of teak, and but little iron was used in any part of the structure.

The striking wedges were placed under each voussoir, as in the French centrings.

As the arch rose from the springing, the crown of the centring was loaded with stones to prevent it rising, and altering the shape of the arch.

The cost of the entire aqueduct, which was about 21 miles long, with all the immediate and collateral works, and including the reservoir, was two millions and a half sterling.

The communication was accompanied by three elaborate drawings of the general construction and details of the aqueduct, with the manner of carrying the stones.

Mr. Charles Vignoles, C. E, the newly appointed lecturer on Civil Engineering at the University College, delivered his introductory discourse on Wednesday last. It embraced a vast number and variety of topics, from the triumphs of this branch of practical science in ancient times, especially among the Greeks, Romans, Italians, and Dutch, down to its more questionable achievements in the present railway era of lavish expenditure, and matchless miscalculation,—and all were treated with great ability, some of them, also, with unusual freshness and originality. The stupendous aqueducts, constructed by the Romans, have been commonly stigmatized as but immense monuments of their ignorance of the simplest principles of science, inasmuch as they seem constructed in utter disregard of the now universally familiar fact, that water, if left to itself, will find its level; but the learned Professor showed that the defects in their construction were much more probably owing to the low state of the metallurgic arts in ancient times, and the difficulty if not impossibility, of their providing pumps, pipes, &c., of strength and capacity enough for sustaining the pressure of large bodies of water. Modern engineers had, he thought, but little superiority to boast of, in point either of scientific knowledge, or engineering skill. The title of "Civil Engineer" was now assumed by any one who had but presumption enough for the purpose, and was notoriously paraded by many, who were alike unqualified by education and by acquirements for so important and responsible a station in society. The Professor proceeded to point out the course of study which he considered requisite to the formation of a good engineer, and dwelt particularly on the necessity of a thorough acquaintance with the mathematics and mechanical drawing. There was, however, scarcely any one branch of the arts and sciences from which an engineer might not draw important aids in the exercise of his profession. How chemistry might lend her helping hand, was strongly exemplified by the highly philosophical researches of Mr. C. W. Williams into the process of combustion, by which the long standing nuisance of smoke seemed likely to be for ever extinguished, and a saving effected of not less than 30 per cent in the consumption of all fuel employed for engineering purposes. How a knowledge of pneumatics might be turned to good account was evidenced in the various contrivances for storing and distributing the gas with which our cities and towns are lighted, and would, he believed, be soon still more strikingly manifested in the atmospheric railway, for which we are indebted to the same ingenious individual (Mr. Clegg) who invented the greater part of our gas machinery. The Professor stated that he had himself not only investigated with great care the principles of this new system of railway transit, but witnessed several most successful trials made of it, and had no doubt whatever of its coming, ere long, into most extensive and profitable use. He cited these "modern instances," (besides others which we have not space here to notice,) not so much because they were among the most remarkable of their kind, as because they were among the most recent. Although true it was that civil engineering was not made, as it ought to be, a matter of regular study by all embarking in the practice of it, and true also, that it had been hitherto almost wholly neglected as a distinct branch of education in our universities and colleges, yet he felt bound to acknowledge, and did so with great pleasure, that there were other means and other channels of acquiring information on engineering subjects, peculiar to the present day, of which engineers did avail themselves to an extent which went a great way to make up—though they could never do so entirely—for the want of early and systematic instruction. He referred particularly, and in terms of great commendation, to the establishment of the Institution of Civil Engineers, to its interesting and edifying weekly conversational meetings, and to the liberal and extensive circulation of its Transactions. Of the value of such an institution as a sort of storehouse for the communications of engineers on all subjects of interest to their profession, it was impossible to speak too highly. He might cite as an appropriate example of

this, the account lately furnished to the institution by Mr. Clegg, Jun., of the Portuguese viaduct of Alcantara—a work as extraordinary for its magnitude as its expense, having cost no less than about 120,000*l.* a mile.* The scientific periodical press had also rendered most important service to the engineering profession; in particular the Mechanics' Magazine, and Civil Engineer and Architects' Journal. The learned Professor concluded by remarking that, in his first series of lectures, his attention would be chiefly devoted to engineering, considered in relation to that grand feature of the present day, the railway system. The discourse was heard throughout with great attention, by a numerous and respectable auditory, and was honoured with several rounds of applause. The Professor is to lecture on the Wednesday of each week till the course is concluded.

ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

*⁎* *Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for that purpose.*

OSBORNE REYNOLDS, OF BELFAST, IRELAND, CLERK, *for improvements in paving streets, roads, and ways.* Enrolment Office, October 27, 1841.

These improvements consist:—

1. In forming the surface of streets, roads, &c. of beams or planks arranged longitudinally and supported on transverse beams, resting on a suitable foundation. The upper surface of the planks is crossed and studded with iron, to connect them together and to obviate the slipperiness of the surface.

2. In forming a foundation for carrying the surface road-way, of wooden planks fastened to longitudinal beams, upon which a roadway constructed as above, or as hereafter described, may be placed.

3. In forming a foundation of transverse and longitudinal rods or beams of iron, or beams of iron or wood, on which curved plates of iron are placed and suitably connected.

4. In forming a roadway of broken stone, or wood, formed into a solid mass by concrete or asphalte.

5. In dishing the upper surface of wooden paving blocks, and inserting in the middle of each a plug of hard wood, iron, &c., flush with the upper surface of the block.

6. In forming a road way of short pieces cut from the trunks of trees, placed vertically, and cemented into a solid mass with concrete or asphalte.

7. In connecting wooden paving blocks, by means of iron or wooden tenous driven into mortices in the contiguous blocks.

ALEXANDER SOUTHWOOD STOCKER, AND CLEMENT HEELEY, BOTH OF BIRMINGHAM, MANUFACTURERS, *for certain improvements in patten and clog ties, and other articles or fastenings of dress.* Enrolment Office, October 27, 1841.

The first improvement consists in making the ties for pattens and clogs of metal plates, perforated to receive the strings, and the nails by which they are attached to the sole of the clogs or pattens. Such plates being covered with leather or other suitable material.

The second improvement relates to hooks and eyes, and consists in raising a convex stop on the plate of the hook, the end of which is turned up and rests upon the stop; so that the eye can only be released by the application of considerable force, and is not at all likely to become accidentally unfastened.

THOMAS ROBINSON, OF WILMINGTON-SQUARE, GENTLEMAN, *for improvements in drying wool, cotton, and other fibrous materials in the manufactured and unmanufactured state.* Enrolment Office, October 27, 1841.

A main shaft or axis revolves in suitable bearings, within a casing or chamber; around the axis are a series of holes for admitting air which is expelled through an opening at the end of the case. The fibrous materials to be dried are placed in two compartments attached to the shaft by side plates; the inner ends of these compartments are closed by a series of bars, and the outer ends by two series of bars at right angles to each other.

A rapid rotary motion being given to the shaft, the wet materials change their position continually, and are forcibly pressed against the outer bars, by which means the water is squeezed from them and escapes through openings provided for that purpose in the bottom of the case or chamber. At the same time the perfect drying of the materials is effected by the air which enters at the side of the casing, and is expelled at the end of the machine, by the action of this large revolving fan or blower. Another arrangement for this purpose is described.

The claim is to the mode of constructing machines for drying wool, cotton, and other fibrous materials in a manufactured or unmanufactured state, as described.

WILLIAM PETRIE, OF CROYDON, GENTLEMAN, *for a new mode of obtaining a motive power by voltaic electricity, applicable to engines and other cases where a motive power is required.* Enrolment Office, Oct. 27, 1841.

Two helices are fixed at right angles to each other in a suitable frame, having a hole in the centre of each, through which an axis passes, extending to where the helices cross

* This account will be found in another part of our present number.

each other at the opposite ends, and working in suitable bearings. On that portion of the axis which is within the helices, a number of permanent or electro magnets are placed, with similar poles adjacent, and having between them some soft substance to prevent vibration and to keep the magnets at a proper distance from each other.

At the outer end of the axis, and revolving with it is a current changer or director, by which the voltaic current is conducted to the helices, passing during the first quarter of the director's revolution through one helix, during the second quarter's revolution through the second helix, during the third back through the first helix, in a reverse direction; and during the fourth, through the second helix in a reverse direction. The current chager and mangnets are so arranged that they will be parallel with each helix when the electric current has passed half through it, so that the continual tendency of the current is to deflect the magnets round in one direction. A pinion on the end of the magne-timpelled axis gives motion to a toothed wheel from which the power may be led and applied to any useful purpose.

The claim is to the application of the deflective action which exists between electric currents and magnets, for the purpose of obtaining a moving power.

ANDRE' DROUOT DE CHARLIEU, OF COLEMAN-STREET BUILDINGS, GENTLEMAN, *for improvements in preparing matters to be consumed in obtaining light, and in the construction of burners for burning the same.*—Enrolment Office, October 27, 1841.

The materials employed for the purposes of the first of these improvements, are volatile or essential oils, and mineral spirits, preference being given to the essential oil of turpentine, and naphtha, on account of their cheapness. These substances being mixed together, are distilled, affording a clear transparent liquid, which is to be consumed in a burner of the following description.

To the centre of the burner, or to each of its holes an upright stem is affixed; the liquid obtained as above, is conducted up to the burner by cotton yarn, and the stem being heated by the flame, volatilizes the liquid, which escapes from the holes of the burner, and burns like gas.

The claim is, 1. To the mode of prepari g matters for the purpose of producing light, by combining essential oils and spirits, and obtaining a liquid therefrom by distillation.

2. To the mode of constructing burners for consuming the liquid above described.

BENJAMIN RANKIN, OF COLLEGE-STREET, ISLINGTON, GENTLEMAN, *for a new form and combination of, and mode of manufacturing blocks for pavement*—Enrolment Office, October 27, 1841.

A long piece of timber, 6 inches square, has two longitudinal grooves cut in one of its ides, and two corresponding tongues on the opposite side; it is then cut transversely into triangular blocks, called base-blocks, and surface-blocks. The former are chamfered at the edges of their bases, and have their apices cut off; the edges of the bases of the surface-blocks are also chamfered.

In constructing a pavement, a series of base-blocks are first laid down, the tenons of each block being inserted in the mortices of the block adjoining; a series of surface-blocks are then laid upon these, their apices being inserted between the base-blocks, and connected therewith by their tenons and mortices.

The claim is, 1. To the peculiar form of blocks, with side-grooves and tenons, as described.

2. To the combining of such blocks, to form a pavement, by the said grooves and tenons, as described.

3. To the manufacturing of the blocks out of long pieces of timber, grooved and tenoned in one length, and afterwards cut transversely, and at certain angles, so as to form the said blocks, as described.

A specimen of this paving has been for some time part exhibited at the Royal Polytechnic Institution in Regent-street, an examination of which will convey a far better idea of the ingenuity and excellence of this contrivance than any written description.

GEORGE TOWNSHEND, OF SAPCOTE FIELDS, LEICESTER, ESQUIRE, *for improvements in machinery or apparatus for cutting vegetable substances.*—Petty Bag Office, October 29, 1841.

A horizontal circular plate is mounted on a short vertical shaft in a suitable framework; two curved apertures are cut through the plate, in which are a series of vertical knives fastened to the under surface of the plate. Above the circular plate extending over the edges of the vertical knives, two horizontal knives, curved to correspond with the apertures, are fixed at their ends upon inclined planes, for the purpose of elevating their cutting edges above the vertical knives. Immediately over the plate a transverse bar is affixed to the frame, from the centre of which another bar projec s at right-angles; these bars by being inclined at a considerable angle, hold the turnips, &c., to be cut by the knives as they fall from a hopper above.

A rotary motion being given to the circular plate, the turnips falling upon it, are carried round, and brought under the inclined bars, which hold them while the horizontal knives cut them into slices, which, being forced against the vertical knives, are cut into pieces, and fall into a receptacle below.

Instead of being a fixture, the apparatus may be fitted to the hinder part of a cart loaded with turnips, &c., and as it is drawn over a field, they will be cut and distributed in a suitable manner for feeding sheep or cattle. In this case a pinion is fitted on the axis of the machine, which is driven by a toothed rim affixed to one of the cart-wheels.

JAMES HANCOCK, LATE OF SIDNEY-SQUARE, MILE END, BUT NOW OF BATTERSEA, CIVIL ENGINEER, *for certain improvements in the manufacture of locks, keys, latches, and other fastenings, part of which improvements are applicable to taps and cocks for drawing off fluids.* Enrolment Office, November 6, 1841.

The nature of these improvements is shown in their simplest form as applied to a cabinet or drawer lock; a round pin or nosel projects from the front plate of the lock, through the centre of which a spiral channel runs from end to end and forms the key-hole. The key consists of a single thread of a screw stripped from its axis (similar to a corkscrew) which is made to correspond exactly with the spiral channel. On the key being inserted in the key-hole, and turned round till its point reaches the inner end of the spiral channel, it there presses upon the heel of the bolt, and unlocks it. On turning the key in the reverse direction, a strong spring throws up the bolt again. The point of the spiral key when once passed through the spiral key-hole, forms a lever by which the bolt of the lock may be acted upon in a variety of ways, and which may be effectively combined with any of the known combinations of wards, guards, tumblers, or other contrivances for affording increased security.

The manner in which these improvements may be applied to taps or cocks is then shown and described.

Instead of the key being a male screw thread, and the key-hole a female screw, the key may consist of a cylinder or pipe with a male screw cut on its external surface, and made to fit a female threaded key-hole, as shown applied to a padlock. The bolt, which is placed longitudinally in the centre of the padlock, is square and solid at its inner end, which passes through the hasp, but at the outer end it terminates in a hollow cylinder with a female screw thread inside, surrounding a central pin, which fits the interior of the pipe of the key. The key-pipe has a male screw on its exterior surface, which exactly fits that in the bolt. At the upper end of the key-pipe it is surrounded concentrically with a hollow cylinder for about half its length. On introducing the key into the key-hole, and giving it a few turns, the shoulders of the surrounding cylinder abut against the body of the lock around the key-hole; on turning the key farther round, the bolt is withdrawn from the hasp, the hollow cylindrical part of the bolt rising from the key-hole into the recess between the key-pipe and its surrounding cylinder. On turning the key in the opposite direction, the bolt is returned into the hasp by a strong spiral spring which surrounds the cylindrical portion of the bolt.

The claim is to the employment for locks and other fastenings, and also for taps and cocks, of keys made of a spiral or screw form, taking or working into key-holes of a corresponding spiral or screw form, whether the said keys are of a male threaded screw form, and the key-holes of a female threaded screw form, or *vice versa.* And whether spirals or screws, of a single, or a double thread are employed; and however such spirals or screws may be varied in the number of the turns thereof, or in the degree of divergence given to the threads; and whether also such keys are made to act directly on the bolts, or other analogous parts of locks, lathes, or other fastenings, or through the medium of any combination of springs, levers, wards, tumblers or other similar contrivances.

## NOTES AND NOTICES.

*Prince of Wales's Gas.*—The following was the distribution of gas light at Guildhall on the evening of Lord Mayor's Day. Three great chandeliers, 6,500 jets of light; 16 Gothic compartments, 6,600 ditto; east window, 1,200 ditto; west window, 1200 ditto; grand star, 2,000 ditto; Queen's Bench, 250 ditto; lobbies, 150 ditto; Council Chamber, centre chandelier, 5,180 ditto; passages, 800 ditto. Total 23 880 jets. Each of the jets giving the light of three wax candles, the whole gave light equal to that produced by 71,640 wax candles, of 11,940 pounds weight. It is calculated that that quantity of wax would burn no more than from five to six hours, whereas the lighting of Guildhall, which commences at half past three o'clock, is seldom turned off till half-past three in the morning. The gas used in Guildhall on this occasion was the first public exhibition of Lowe's patent gas,* to which the inventor gives the name of Prince of Wales's gas, in commemoration of the birth on the same day of the Heir Apparent to the Throne.

*Case Hardening.*—The inventor of case hardening by means of the prussiate of potash, respecting whom enquiry is made in the *Mechanics' Magazine*, vol. xxxi, p. 372, was Mr. Charles Payne, formerly of the Royal Adelaide Gallery. I tried it for him three or four years ago. J. W.

* Abstract of patent given at page 285 of our 917th number.

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# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE

No. 954.] SATURDAY, NOVEMBER 20, 1841. [Price 3d.

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JOEST'S PATENT PROPELLERS.

Fig. 1.

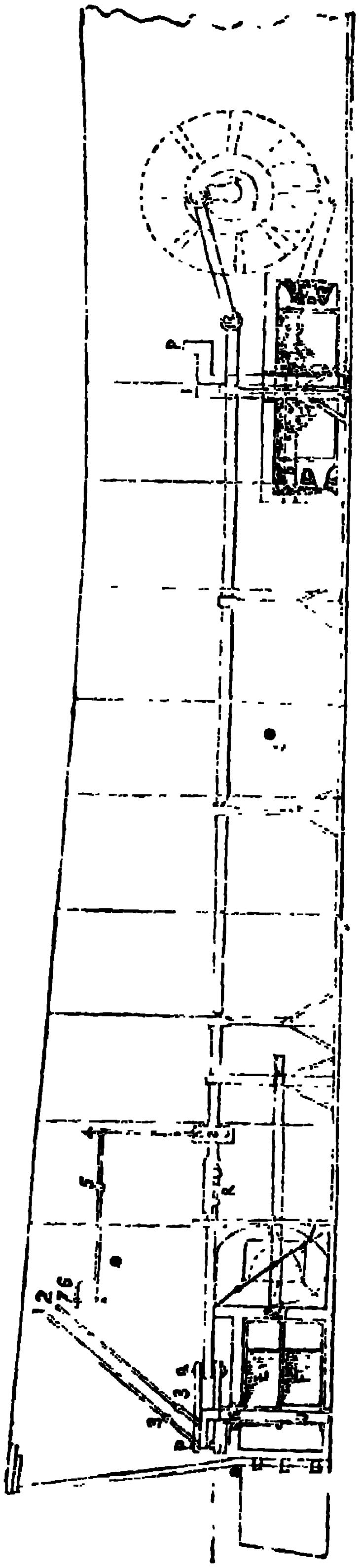
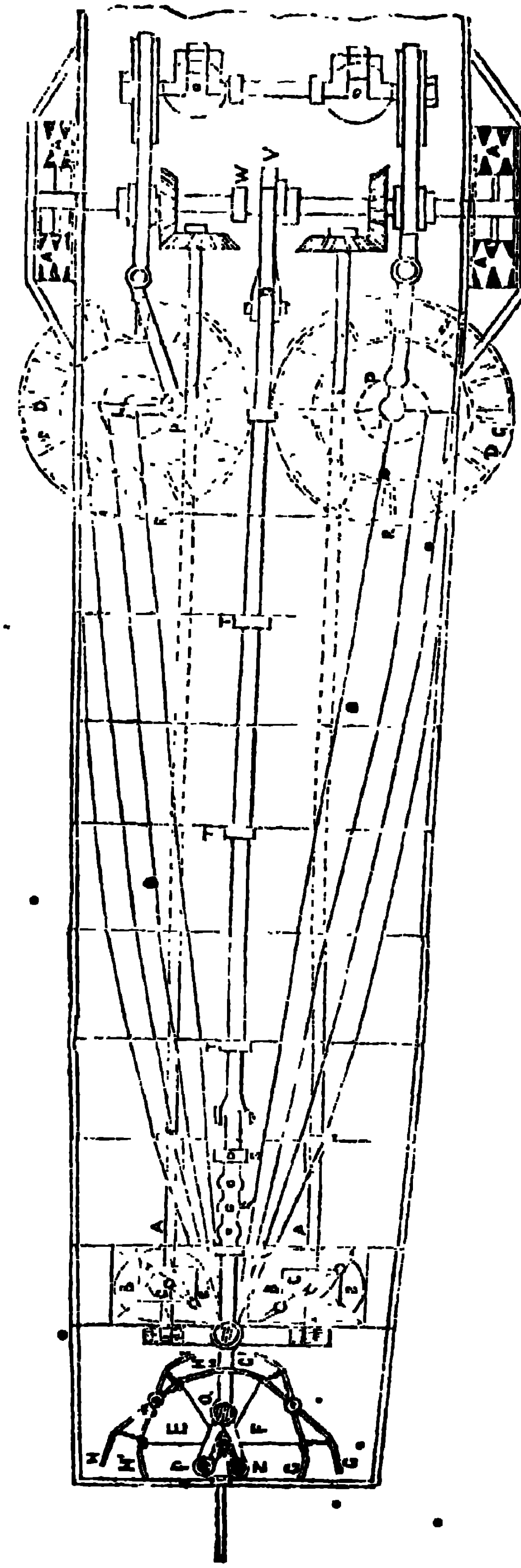


Fig. 2



JOEST'S PATENT PROPELLERS.

Among the specifications of patents recently enrolled is one by Mr. Joest, for certain improvements in propelling vessels:* these improvements include four separate plans, which have been communicated to the English patentee by the inventors, M. A. W. Beyre, and Dr. O. Garthe, of Cologne. In the specification, of which the following is an abstract, these several propellers are described as the "Double Fish-tail," the "Syphon Screw," and the "Paddle-wheel with Double indented Float-boards"—the latter being vertical, or horizontal.

Fig. 1, on our front page, is a vertical section, and fig. 2, a ground plan of part of a steam-vessel fitted with all these four methods of propulsion.

The "double fish-tail propeller," which may be constructed of metal plate or of wood, consists of a hollow prismatic figure E F, to which the flags or fans H G are jointed, being also connected together by a chain; they are placed beneath the stern of the vessel, and mounted upon an axis N O, which works in strong top and bottom bearings, bolted to the upper and lower stern-posts: a stuffing-box in the upper post keeping the joint water-tight. When the propellers E and F are situated round the same axis, the uppermost, E, is affixed to a hollow shaft, turning round upon the axis N O, to which the lower one, F, is attached. The propeller E, which lies uppermost in the case, turns to the left, in the direction of the propeller F, at the same time that the latter turns to the right, in the direction of E; the fans H H, G G, taking alternately the positions H′ H′, G′ G′, in order to avoid backwater. The propellers are moved by cranks, N Z, N P, which are guided to and fro by the connecting-rods Q Z, Q P, actuated by the sliding-bar V Q, lying in the bearings T T, which receives its motion from a crank, W, on a second gearing from the engine to give the required speed.

If the bar V Q is driven by being immediately connected with the engine, the working cylinders thereof should be placed horizontally, the direct action of which would give the to and fro motion required for this form of propeller. R S are levers for throwing the slide-bar in or out of gear with the propellers, when it is required to reverse them, which may be done by the pilot or helmsman, by means of the levers 1, 2, 3, 4, 5, 6, 7, or by means of an arrangement of mechanism from the engine-room. In order that the propellers may be reversed, so as to back the vessel astern, sufficient space must be left between the two stern-posts to allow the propellers to be turned half round upon their axis N O.

The double fish-tail propellers may be placed on each side the keelson, under the stern, the bow, or any other convenient part of the vessel, and each having its own sliding-bar and connecting-rod, the vessel may be steered therewith, instead of by the rudder, by stopping either the one or the other, according to the direction in which the vessel is to be turned. These propellers may also be used singly, or more than two may be employed, and for deep water they may be placed on each side of the keelson, in a vertical position, like the common paddle-wheel, but with this difference, that they only vibrate, and do not revolve like a paddle-wheel. The flags or fans H G may also be guided with chains, as shown in the drawings, and by an eccentric on the axis N O, so as always to bring them into the most advantageous position for working.

The "Syphon Screw," (so called from the circumstance of the water being forced, without contraction, through the different working parts of the screw,) consists of a spindle, A, fig. 3, to which the arms D D are fixed, with their broad sides in the direction of the screw-threads. To these arms is screwed a hollow metal cylinder, C C, to which the blades or threads, B B, of a common screw are fixed; straight blades may also be fixed to the hollow cylinder, at angles of 25°, 50°, 60°, or 70° with the axis or spindle A. The diameter of the hollow cylinder C must be larger or smaller in proportion to the size of the syphon screw, the length of the former being always half that of the syphon screw. The threads or

* Patent sealed May 6, 1841.

Fig. 3.

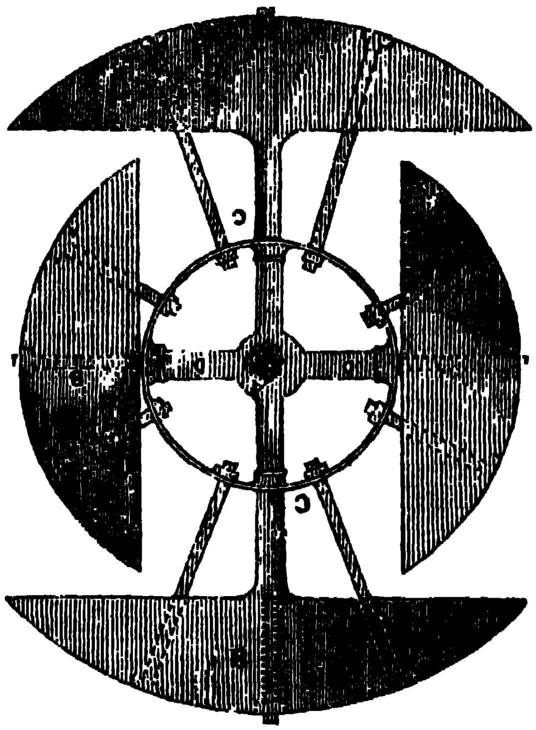
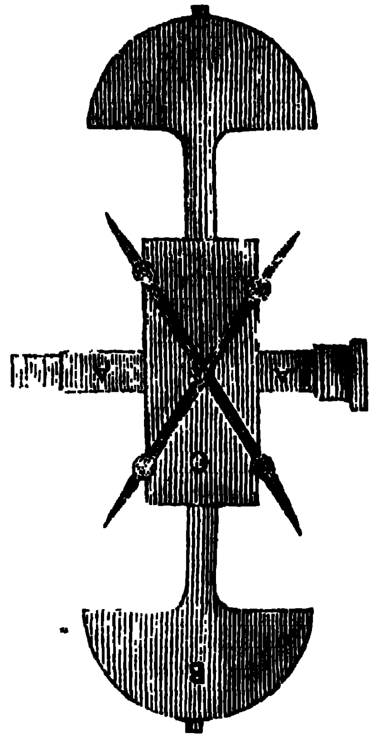



Fig. 4.




blades B may be placed perpendicular to the axis A, or they may be inclined in the direction of the rudder. The number of blades is also determined by the diameter of the syphon screw.

In rivers, canals, and other shallow waters, two syphon screws are to be used, one on each side of the keelson, either at the stem or stern of the vessel, and being worked separately, they will serve both to propel and steer the vessel. For deep water and ocean navigation, one syphon screw only is recommended—to be so placed that its upper part shall be from one foot to two feet below the water line. The syphon screw may be from two to four feet long, but not greater than four feet, even in the largest vessels.

Fig. 3 is an end view, and fig. 4 a side view, of one form of this propeller shown enlarged and detached from the vessel; numerous modifications of it, however, are shown and described in the specification. These propellers are shown as being driven by bevel wheels on the second gearing of the engine, so as to obtain the required velocity. The "double indented paddle-wheels" are shown in figs. 1 and 2, as applied both vertically and horizontally; the peculiarity of these paddles consists in their float-boards being disposed around their circumference in pairs, their surfaces being so indented or cut away, that the part A, which is cut away in the one float-board, may be exactly covered by the part B in the one behind it.

The indents may be rectangular, sharp pointed, or of any other form that may be deemed most advantageous, several plans being given for that purpose, as long as they are constructed upon the foregoing principle, of the one covering the other. It is proposed to make these paddles much smaller than those in use at present, to compensate for their diminished size by an increased velocity, and to immerse them deeper in the water; the water will, it is said, fall off so quickly from the indented floats, as to occasion little or no backwater.

In order to obtain the required speed, the paddle-shaft is not driven directly by the engine, but by means of endless belts passing round a drum on the engine-shaft, and round small pullies on the paddle-shaft.

The horizontal paddles are constructed of a hollow metal drum, on the cylindrical exterior of which are screwed the indented float-boards, C D, connected at their outer extremities by an iron ring or hoop. In the centre of the water-tight drum is placed the spindle L, having a crank, P, at its

upper end, set in motion by a connecting rod from the steam-engine.

These paddle-wheels work in water-tight casings placed horizontally on each side of the keelson in the broadest part of the vessel, open on the outer sides only to the water, where the wheels project slightly beyond it. A considerable velocity being given to these wheels, the water will, it is supposed, be prevented from entering the casings or boxes, and the evils of back-water be thereby avoided.

The size of the horizontal paddle-wheels is limited by the breadth of the vessel, beyond the sides of which they should not project more than two feet.

Several peculiar advantages are claimed by the inventors, for each of these propellers, which will shortly be put to the test of practice; a vessel impelled by a steam-engine of 32-horse power being now in the course of being fitted with them. The results of this experiment we shall have much pleasure in laying before our readers.

## IMPROVED PREVENTOR.

Fig. 1.

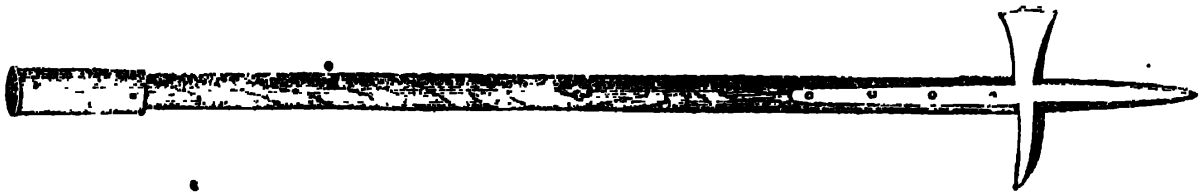
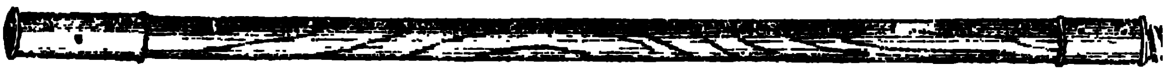


Fig. 2.



Sir,—The accompanying sketch represents an improved "Preventor" designed by me, at least fifteen years ago, and which then, as now, I think might be introduced into all fire-establishments with great advantage.

The preventor hitherto used is simply a common boat-hook, and consists of a pole about 10 or 12 feet long, with an iron head having one straight prong at the end, and another at right angles to the former near its base. Its name seems to have been derived from its use in preventing accidents from the falling of loose bricks, beams, etc.; by enabling the fire-man to pull them down, and thus forestall their falling. It is constantly employed for this purpose, and for stripping roofs, as well as being used for pulling down the ceilings of rooms, staircases, &c. when fire has got therein. When used externally, it is often found to be deficient in length; while used internally, it is often found too long.

In order to meet all these circumstances, to increase its general usefulness, and to adapt it to every emergency, I proposed that the head should, in addition to its present straight and side prong, have a cutting axe opposite to the latter, something after the fashion of the halbert, and other ancient war-like instruments. I also proposed that it should be made in two parts: the first (fig. 1,) being a short ash pole six feet long, having the head affixed at the one end, and a strong female screw ferule at the other; the second part, or pole, fig. 2, to have a corresponding male screw ferule at top, and a similar female screw at bottom. Constructed in this manner, when required to be used within a building, the first, or top joint, alone would be found extremely handy and convenient; but if needed externally, the second joint being screwed on, its length would be extended to 12 feet. If a still greater length was necessary, another of the joints, fig. 2, could be added, or even a third, making its length 18 or 24 feet, at pleasure.

In this form the "Preventor" could be more conveniently carried upon the engines than at present, as the parts might be stowed away in the side

pockets or within the hose-box, instead of being strapped to the handles, and obliged to be taken off (whether wanted or not) before the engine is set to work. Such "Preventors" might also be conveniently carried by parish, and other small engines, to which in their present form they are inapplicable.

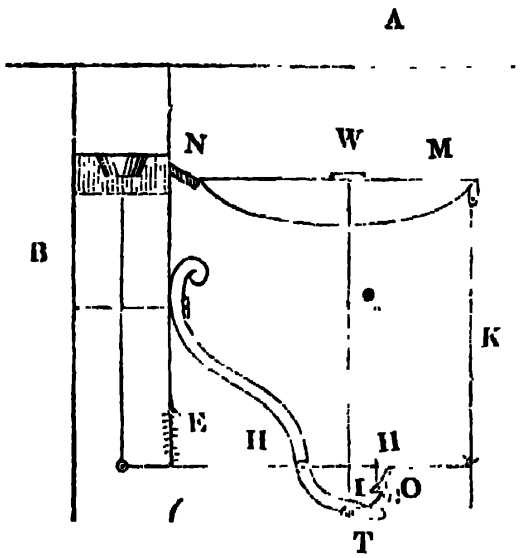
When capable of being indefinitely extended in this way, they would also become serviceable for forming communications by handing up lines, for hauling up hose, for the preservation of life, and various other purposes.

I remain, Sir, yours respectfully,

WM. BADDELEY.

London, November 9, 1841.

APPARATUS FOR REGULATING THE SUPPLY OF WATER IN STEAM BOILERS.




Sir,—Having lately contrived the following apparatus for regulating the water in steam-boilers, and wishing to know whether it is original, I have sent it where I think I shall soon learn all about it. I have made the apparatus on a small scale, and it answers very well, acting with the utmost precision.

A is the top of the boiler, and B a pipe going down into it, as low as is thought necessary; the pipe has a slit at E, in order that the rod H H may have free play; the catch O turns on a pivot at T; M is the float, secured by a hinge at N.

The action is as follows. When the float M descends, it pushes one end of the lever H down by means of the rod K. This rod is not fastened to the lever H, but slips through a loop at the end, and pushes it down by means of the cross-piece I. The two arms of the lever being equal, if the lever is depressed one inch, it raises the valve an inch. As the lever H descends, the little cross bar slips over the catch, by which time the valve will be fully open. When the float ascends, the rod K slips through the loop at H, without drawing the lever H up, it being held by the catch O. But when the float reaches the proper height at which the water should be, it catches the button at the top of the rod W, which immediately draws the catch a little to the right hand, so that the cross bar slips off, and the valve immediately falls into its place.

I am afraid I have been rather diffuse in my description; but as this is my first communication, I hope it will be excused.

I am, Sir,

Yours sincerely,

W. H. R.

Hanley, Staffordshire Potteries, October 21, 1841.

NON-CONDUCTORS OF HEAT FOR STEAM-BOILERS.

Sir,—Although "R. R." is made (evidently by a misprint) to ask for "the best *conductor* of heat for covering a steam boiler," I can very well understand what he is in search of.

There are three distinct classes of bodies at present employed as non-conductors for this purpose, of which "R. R." can take his choice. The first is the *patent felt*, which has been, I believe, pretty extensively used as a non-conductor around the boilers of marine engines with great success.

The second consists of calcareous and earthy substances, as Roman cement, and the like: at the Fire Preventive Company's works, in Upper Ground Street, Blackfriars Road, their boiler is coated with their fire-proof cement, which answers extremely well for the purpose.

The third material is refuse ashes or cinders, which I have seen applied to the boilers of the engines at the East London Works, by Mr. Wicksteed. This is certainly the cheapest, and I believe nearly, if not quite, the best

that can be employed in such situations. I remain, Sir,

Yours respectfully,

W. BADDELEY.

November 5, 1841.

### ON THE EMPLOYMENT OF GAS AS A SUBSTITUTE FOR COKE IN LOCOMOTIVE ENGINES.

Sir,—Coke is, I believe, mostly used for locomotives—this is a bulky article; might not gas be used with great advantage to heat the water? Jets of gas, lighted as we see it in letters at illuminations, &c., might be burnt in the tubes of a boiler, and I think would do better; no sparks or cinders would then annoy the passengers, or ignite the goods in the train; the fire could be raised instantaneously, and could be regulated with the greatest nicety; it would require much less attention, and, I am inclined to believe, be more economical, though this is a question which experience alone will decide. Gas is condensed and made portable by the various Companies in the metropolis, and these holders might be carried in lieu of coke. So far as raising the steam is concerned, gas would be far superior to coke; I cannot speak so confidently as to its expense or its portability: at any rate, the plan would be worth trying. To stationary engines, I feel convinced, it might be applied in lieu of coal with advantage, because it could be applied so easily to all parts of the boiler, and a very small jet constantly burning gives out an intense heat.

I am, Sir, yours truly,

D. J.

Southwark, October 22, 1841.

### E. A. M.'S NEW THEORY OF THE UNIVERSE.

"Nature made that revelation to him; and ordered him to speak it out. He got it spoken out; if not well and clearly, then ill and dimly—as clearly as he could."—*Professor Carlyle.*

Sir,—May I trespass on your indulgence to correct an error in my last communication, (p. 357,) where I asserted that "ironized heat" (the magnetic fluid) "would be found the most universally diffused of fluids." I ought to have said, of compound fluids; cold and heat being the occupiers of what has been called space, wherever it has been supposed to exist.

In the History of the Inductive Sciences, Mr. Whewell says:—

"Thus the science of Thermotics, imperfect as it is, forms a highly interesting part of our survey, and is one of the *cardinal points* on which the doors of those chambers of physical knowledge must turn, which hitherto have remained closed."—Vol. ii. 534.

Again—

"We have here no example of an hypothesis which, assumed in order to explain one class of phenomena, has been found also to account exactly for another..... Such coincidences are the best *test of truth*; and thermotical theories cannot yet exhibit credentials of this kind."—Vol. ii. p. 524.

I cannot help flattering myself that, on examination, my theory will display the above test, not only in a few instances, but in all.

"On the beaten road there is tolerable travelling; but it is sore work, and many have to perish, fashioning a path through the impassable."—*Professor Carlyle.*

Having now offered the most important points of my theory to the public, allow me to thank you for the obliging assistance which you have afforded me in doing it.

I remain, dear Sir,

Your obliged obedient servant,

E. A. M.

P. S. I shall, no doubt, be again induced soon to intrude.

November 11, 1841.

### ON THE SETTING FAST OF THE WHEELS OF CARRIAGES WHEN TRANSPORTED ON RAILWAY TRUCKS.

[At page 5 of our present volume, a correspondent directed attention to a "Singular Railway Phenomenon," viz., the setting fast of carriage-wheels, while being conveyed on railway trucks. We then stated that this subject had been investigated by Mr. David Davies, the eminent coach builder, and that gentleman has politely favoured us with the following results of his observations on this subject, and also

an effectual remedy for the evil complained of. Ed. M. M.]

The fact is now well established that in consequence of a particular motion to which wheeled carriages are subject when carried to any considerable distance upon railway trucks, their wheels become fast. When I first had this complaint made to me, I confess I did not give much credence to it, supposing it to come from persons prejudiced against railway travelling. I thought it impossible that patent axles should receive any injury while on the trucks, but in consequence of such complaints becoming more frequent, I was induced to go down the Birmingham and Grand Junction lines, with a carriage I had to convey to a customer of mine at Liverpool, in order to ascertain the truth of the reports I had heard, and to make my own observations on the action of the carriages while on the truck. When I got to the Liverpool station at night, and was about to put-to the horses, to my surprise I found *three of the wheels out of four* were fast, and if it had not been for the kind assistance of a gentleman who superintends the carriage department at Liverpool, I should have been subjected to very great inconvenience. I think it very desirable that the Railway Company should construct, and so fix gentlemen's carriages on the trucks as to prevent any injury to the arms of the axle-trees, or the boxes in the wheels. I will first of all point out what I consider to be the evil of the present mode of fixing gentlemen's carriages on the trucks. They are mostly fixed on the trucks with two long bars cross-wise to the truck, to take the front and hind wheels, having notches in them to take the rims of the wheels; and at each end of each bar there is an iron plate with a hole in it to receive an iron pin, which is so fixed and regulated at the top sides of the truck with holes alternately, as to accommodate the length of the carriage. By fixing the wheels firmly on the truck, the constant oscillation of the body upon the carriage, and the side motion of the carriage, produce a great friction of the arms of the axle-trees in the boxes of the wheels. Being thus firmly fixed on the truck, as soon as the carriage is put on the railway, the oil in the boxes ceases to flow; it either drains into the brass cap of the wheel, or the reservoir of the box, and not a single revolution of the wheel takes place to diffuse or circulate the oil on the arms, where it is most wanted. I have thus endeavoured to point out the cause of the axle-trees sticking fast on railways; I will now propose a remedy. The trucks should be so constructed as to allow the wheels to go into two wooden channels, sufficiently deep to allow the platform between the channels, to take and support the carriage, and leave the wheels at perfect liberty, which would at once obviate all the inconveniences attending the present practice.

D. Davies.

15, Wigmore-street, Cavendish Square, November 10, 1841.

## THAMES AND CLYDE STEAMERS.

Sir,—I see in your valuable journal of October 30, a letter signed "Vulcan," on the merits of the *Wallace* and *Burns* newly imported Scotch boats; in which he shows, that so far from the *Duchess of Kent* and *Duke of Sussex* steamers having any advantage over the *Wallace* in a trial some time ago, it was just the contrary. How very surprising! But how is it that "L. S.'s" statements were not contradicted before? With no wish to impugn any of "Vulcan's" statements, perhaps I can offer a few suggestions which may somewhat tarnish this grand affair. In the first place, had not the *Duchess of Kent*, at the time referred to, been running every day, Sundays included, for some months, and were not her engines in consequence somewhat deteriorated, as all who have such close work as that vessel has had, must be? Secondly, was not the *Wallace* carefully overhauled previous to the trial, and is not her pressure double that of the *Duchess?* All these questions ought to be fairly answered before we can decide on the merits of the two vessels. The fact of the *Wallace's* safety valve being exposed, puts a great temptation in the way of those who may be willing to increase the pressure; and I should be obliged if "Vulcan" would inform me under what pressure the *Wallace's* engines are worked, and whether they were worked at their usual pressure on the day of trial? Let me also remark, that both the *Duke of Sussex* and the *Duchess of Kent* are only third-rate boats on the Thames, and that neither of them was ever remarkable for great

speed. With respect to the *Burns* making the quickest passage ever effected between Southampton, Torquay and Plymouth, I would just remark, that no boat ever having any pretension to speed has been placed on that station, and that there is nothing so very remarkable in a boat just overhauled going pretty fast on her first trip or two. Let "Vulcan" produce a table, containing one year's performances of both the *Burns* and *Wallace*, and then we shall have some data to go upon, but as yet we have had nothing shown whereby we may perceive the great superiority of Clyde over Thames steamers.

I remain, yours, &c.

NAUTICUS.

[We are tired—not less so, we suspect, than most of our readers—of this discussion; but there is still one letter from the Clyde champion, A. M., for which we must find room in our next or following number.—ED. M. M.]

## ON THE EVAPORATIVE POWERS OF BOILERS—BY C. W. WILLIAMS, ESQ.

Sir,—I have to thank you for the favourable notice in your Magazine for October, pp. 327 and 337, of my mode of increasing the evaporative power of boilers, and beg to add a further illustration on that interesting subject.

My object is to show, 1. The practical error of considering the effective power of a boiler as the result of a given amount of flue surface.

2. That if such be erroneous as to *boilers*, it is still more so as to the evaporative power of different kinds of *fuel*.

3. That with the present construction of boilers, and their defective powers of transmitting heat, the weight of water evaporated cannot be taken as a test of efficiency, either of boiler or fuel.

4. That the weight of water evaporated by ordinary boilers may be increased without increasing the size, either of the flues or furnace; and that even an inferior fuel may be made to produce greater evaporative effect than is generally obtained from the best.

In my former paper, I distinguished between the generation of heat in the furnace, and its application to evaporation in the flues. The accompanying diagrams will further illustrate the improved system of evaporation.

Figs. 1, 2, and 3, represent three experiments, each with a series of three distinct boilers, A B and C, so connected by their flues, that the heat, after passing though the first, is carried on through the second and third. Each of the three boilers was charged with 11lbs weight of water, the total in each experiment being 33lbs. On inspection of the diagram, it will be seen that the only difference between the three experiments consists in the change in the situation of the boiler A, which was furnished with the conduction pins, while the other two, B and C, have plain surfaces in the ordinary way. In fig. 1, the conduction boiler A, occupies the first place, nearest the flame, and, consequently, receives the greatest heat. In fig. 2, it occupies the second place; and, in fig. 3, the third place. The quantity of gas consumed (and consequently the heating power) as well as the time employed, was the same in each experiment, namely, 30 cubic feet of gas in two hours and forty minutes. Thus, the quantities of fuel consumed, and heat generated, were the same in all. It will now be seen that the evaporative powers of the three boilers respectively, arising from their relative positions, were as follows.

*Experiment*—Fig. 1.

| | lbs. | oz. |
|---|---|---|
| A, conduction boiler, evaporated.. | 3 | 2¾ |
| B, plain boiler ................ | 0 | 11¼ |
| C ........................ | 0 | 7¼ |
| Total evaporated | 4 | 5¼ |

*Experiment*—Fig. 2.

| | lbs. | oz. |
|---|---|---|
| B, plain boiler evaporated ...... | 1 | 2¾ |
| A, Conduction boiler............ | 2 | 2 |
| C, plain boiler ................ | 0 | 10¼ |
| Total evaporated | 3 | 15 |

*Experiment*—Fig. 3.

| | lbs. | oz. |
|---|---|---|
| B, plain boiler evaporated ...... | 1 | 3¾ |
| C ........................ | 0 | 11¼ |
| A, conductor boiler ............ | 1 | 14¾ |
| Total evaporated | 3 | 13½ |

We here see that the conductor boiler A, wherever it is placed, (as regards its distance from the flame,) surpasses, in evaporative power, both the

other two. But there is another instructive and highly important fact, elicited by these experiments, namely, that although the three boilers A, B, and C, taken together, present the same amount of heating surface, and conducting power, yet the sum of their evaporative effects bears a palpable relation to the place in which the conductor boiler A stands.

Fig. 1.

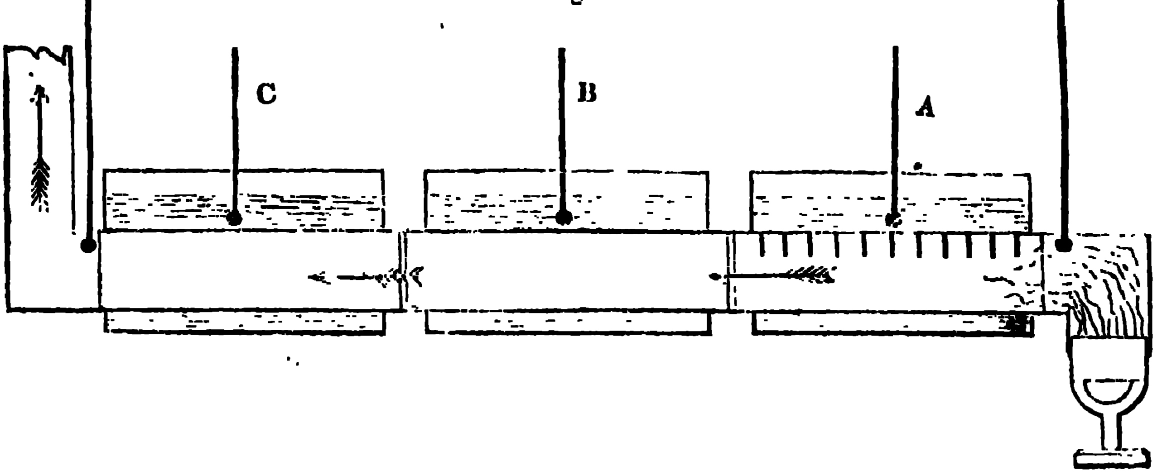



Fig. 2.

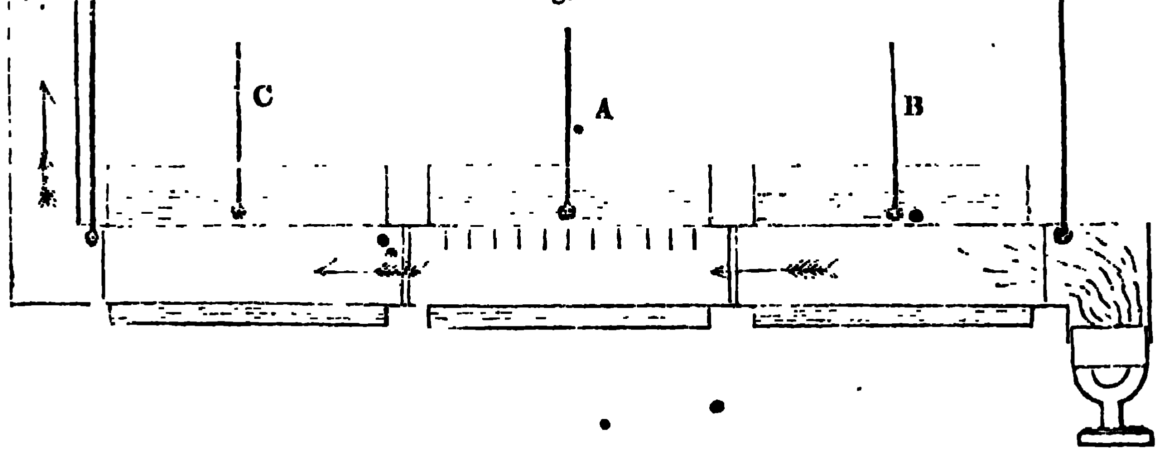
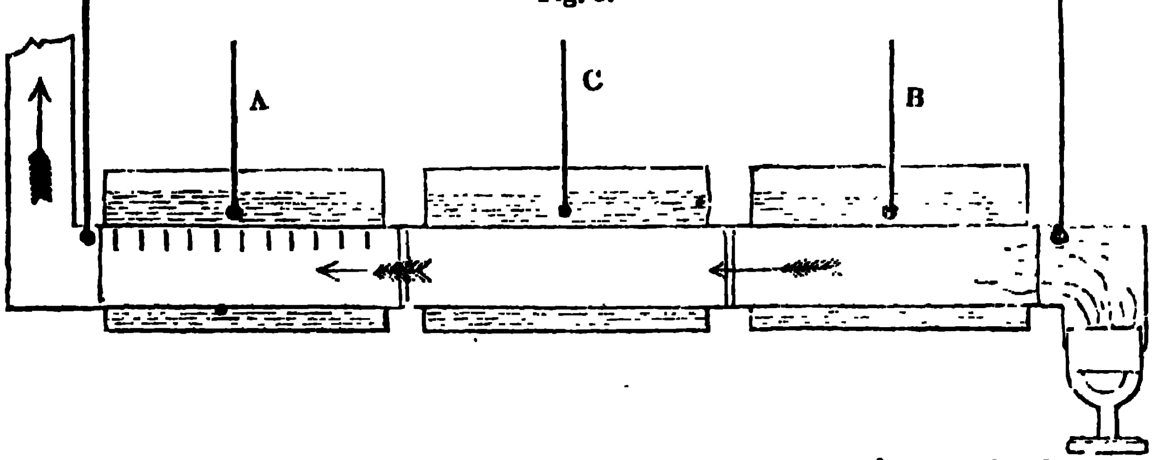



Fig. 3.




Thus, the sum of the weights evaporated in the 3 experiments is as follows:

| | lbs. | oz. |
|---|---|---|
| Fig. 1, the total evaporated is.. | 4 | 5¼ |
| Fig. 2 .................... | 3 | 15 |
| Fig. 3 .................... | 3 | 13½ |

Now this great difference in the total weights evaporated, is due solely to the fact, that in fig. 1, the conduction boiler, being placed nearest the flame, the capability of the conductors was brought more into action; and conse-

quently, more heat was transmitted by their instrumentality, in a given time; and so in proportion when it was placed on the second or third distance from the flame.

I would here observe, how these results prove the insufficiency of calculations based on the principle of the evaporative power of a boiler having a necessary and defined relation to its size, or the amount of heating surface of the flue plates. Elaborate tables of evaporative effects, deduced from comparative surfaces of flues and grate bars, are proved to be utterly at variance with fact, as soon as an improved system of combustion, and a more effective absorption of heat, are brought into action. It would appear, indeed, that an entirely new class of elements and proportions must be referred to before we can even approximate to the relative value of any kind of fuel, description of boiler, or size of furnace.

Hitherto, so entirely has the subject of boilers and furnaces been considered as resolvable into mere mathematical calculations, instead of chemical conditions, that our ablest practical men have unfortunately had their attention too much directed to elaborating these calculations from data which have no real existence or connexion with the subject. One author (and many follow the same *ignis fatuus*,) observes, that "the evaporative power of a boiler is a certain function of the heating surface and area of fire grate, combined with *constant quantities* expressing the peculiar heating qualities of the fuel, which can be ascertained, experimentally, to any degree of exactness required." Where this "*constant quantity*" is to be found has never yet been discovered: and I have already shown that the heating surface and area of fire-grate are wholly irrespective of that evaporative power, of which it is alleged to be a "*certain function.*"

The same author observes, that "thus the principal elements of the power of a boiler admit of *exact mathematical calculations.*" Now this is so entirely beside the real questions at issue, and so utterly at variance with fact in every particular, that I may be excused, at present, for not enlarging on it. Tredgold and other able men have fallen into the same oversight, attributing, to mathematical calculations, what exclusively belongs to chemistry: thus unconsciously practising a species of self-deception which has turned them away from the only path that could lead to practical improvement. By many, indeed, we have this carried so far as affecting to give precise formulæ for, "finding the horse-power—the area of fire-grate—and the area of effective heating surface," and giving them as infallible rules for producing a given quantity of steam. And how can these rules be doubted? Do not we see they are "*mathematically correct?*" Yet all this display is made without any reference to the quantity of fuel which could effectively be used on any given sized grate—the quantity of heat that could thus be generated—the quantity of air that could, or should, be introduced—the amount of absorbing power which such "effective heating surface" could bring into operation—in fact, without any reference to the real essentials in the case, namely, the perfection of the process of combustion—the amount of available thermometric heat generated—the quantity actually taken up by the water—or the amount of heat lost, by escaping through the chimney shaft.

This is indeed exalting mathematics at the expense of chemistry, and on a purely chemical subject. Yet what should we say of the mathematical professor assuming the chemical chair at any of our colleges, and endeavouring to persuade his class that the effective completion of any difficult and complicated process in which those wonderful elements of nature, hydrogen and carbon, oxygen and nitrogen were to be brought together, and combined, in exact proportions, and at a given temperature, to produce a given effect, was all reducible to "*exact mathematical calculations;*" and that the effects to be produced, with their curious and involved compounds, were all "certain functions" of the heating surface of the retort, and the area of the furnace or bath, on which the retort was laid, combined with some undefined, though "constant quantities" of the peculiar heating qualities of the fuel employed? Let us ask, if the pupils of such a class were likely to become good practical engineering guides?

Now, the experiments above alluded to, (and which I have so tested on the large scale,) have proved, that practically we may increase, and even double, the evaporative power of many boilers, as hitherto constructed, without enlarging either the fire, or the flue surfaces. The great drawback to the production of any given evaporative effect, from any given number of metallic conductors, is to be found in their tendency to become charged with soot in the flues, and which, from its non-conducting influence, too often counteracts the transmitting power of these conductors. This can only be remedied by *effectually preventing the generation of smoke in those flues*, and which is an additional reason for producing a more perfect combustion of the gaseous portion of coal from which alone smoke is generated.

Another, though lesser drawback, arises from incrustation, should any portion of the conductors project in the liquor to be evaporated; and from the impediments they present to keeping the interior clean, and free from uncrystallized *deposit*. For these reasons, I would generally dispense with internal projections.

Orifices of ½-inch diameter, admitting the introduction of ½-inch conductors, and without any projection, as shown in the annexed diagram, are fully equal to the transmission of the heat absorbed by the surface of pins of 3 inches in length. On a future occasion, I will, with your permission, furnish some curious and important illustrations of the relative value of quick and slow firing as referable both to longitudinal and transverse conduction.

I am Sir, yours, &c.,

C. W. Williams.

Liverpool, November 1, 1841.

DESCRIPTION OF THE STATIONARY ENGINES AT THE NEW TUNNEL ON THE LIVERPOOL AND MANCHESTER RAILWAY. BY MR. JOHN GRANTHAM, ASSOC. INST. C. E.

[From Trans. of Soc. of Civil Engineers.]

This communication gives a description of two pair of stationary non-condensing engines, which were constructed by Messrs. Mather, Dixon, and Co., of Liverpool, from the designs and under the superintendence of the author.

The steam cylinders are 25 inches diameter, with a length of stroke of 6 feet; they have side levers like marine engines, but the connecting rods are reversed, and convey the power downwards to the machinery, which is placed in vaults cut out of the sandstone rock: upon which the beam pedestals are fixed without any framing. Cast-iron slides are used instead of the usual parallel motion, and after several years' constant use, they exhibit no marks of deterioration.

The drum wheel is 21 feet diameter, and makes usually twenty-two revolutions per minute, when drawing up a train at the rate of 15 miles per hour; there is a groove in its periphery, at the bottom of which is wound a small cord to form a bed for the main rope to rest upon—this main rope encircles about two-thirds of the circumference; it is made of the best Russia hemp, in three strands, patent shroud laid, the inner strand being composed of 40 yarns of white hemp, overlaid by 40 yarns of hemp, tarred to the point of saturation; this arrangement is found most conducive to the lightness and durability of the rope; its circumference was six inches, and its length, when new, was 4,800 yards: in the first few weeks it stretched to the extent of 10 per cent. of its length, after which it remained unchanged under the tension imposed. The total weight is 8 tons 8 cwt., and the cost was 2*l.* 8*s.* per cwt. It is guided by 474 grooved pulleys, 14 inches diameter, and by 6 sheaves 5 feet diameter. A new rope will last well for three years, after which it is renewed by splicing in a short portion each time, so as to reduce the amount of stretching.

The length of the inclined plane is 2,370 yards, at varying gradients; giving an aggregate rise of 77 feet 1 inch, and a mean rise of 1 in 92. The tunnel is 2,220 yards long. The average weight of the trains drawn up is 55 tons—and the time occupied is six minutes. The pressure of steam is usually from 50 lbs. to 60 lbs. when the engines begin to wind, and sinks gradually to about 30 lbs. in the reservoir during the time it is working.

From some experiments made by Mr. Edward Woods, the details of which are given, it has been ascertained that each pound per square inch pressure of steam upon the pistons over and above the 7·56 lbs. necessary to overcome the friction of the machinery, is capable of drawing one carriage weighing 5 tons gross up the inclined plane.

On the first erection of these engines, in order to comply with the provisions of an act of parliament, it was necessary to work them with steam generated in boilers, at a distance of 448 yards, and conveyed through pipes 10 inches diameter, laid in a tunnel excavated

through the rock. Several experiments were made to determine the relative amounts of pressure in the boiler and the steam reservoir, and the quantity of steam which was condensed in a certain time. The results were, that when the engine was standing still, the difference of pressure was about 3 lbs., and when working with a load it was as much as 13 lbs. The quantity of steam condensed was on an average about 156 gallons per hour.

Subsequently a set of tubular boilers, similar to those of locomotive engines, were erected close to the engines, and are now constantly worked instead of those at the great distance; the economy of fuel has been considerable. The consumption of gas coke under the tubular boilers is about 15 tons per week, at ten shillings per ton. The larger boilers consumed about 30 tons in the same time.

Mr. Edward Woods gives his approval of the action of the engines, and of the employment of non-condensing engines generally for this class of work, on account of their great simplicity, and the readiness with which they may be brought into full action, so that the greatest power is always at hand to start the train; whilst during the intervals of working the steam may be suffered to accumulate. These advantages are rarely attainable with condensing engines, as unless a small engine be employed to keep up the vacuum, there is a difficulty in starting them with the train attached to the rope.

This communication is accompanied by four detailed drawings of the engines and machinery, and by a model of Mr. Grantham's apparatus for regulating the admission of steam to the valves.

## STEAM NAVIGATION ON THE SHANNON.

(From *Saunders's News Letter.*)

From Athlone down to Tarbert, upon the Shannon, the only point where the circumstances of the navigation have hitherto prevented the use of steam vessels is that between Killaloe and Limerick, a distance of twelve miles. The navigation here consists chiefly of a canal of about 40 feet in width, on which the Inland Navigation Company now convey passengers, from their steam vessels arriving at Killaloe and Limerick, by means of a fly-boat tracked by horses.

It has long been considered most desirable to substitute for this a steam-boat of larger dimensions, giving greater comfort and accommodation to passengers, with greater safety, and capable of being wrought at less cost than the fly-boat. Until, however, a recent period, the many obstacles that beset the difficult problem of steam navigation on narrow canals has precluded the possibility of this.

About a year and a-half ago the Secretary of the Inland Department of the City of Dublin Steam Packet Company secured, by patent, a method of passing through a canal lock of given dimensions a boat of narrow beam but of great length, and this invention has opened a fresh field for the application of steam power on canals, which seems likely to have the most important results, inasmuch as by it some of the greatest difficulties in the way of navigating narrow canals by steam are avoided.

When a body floating on a canal, such as a boat, is put in motion along it, a wave is immediately produced just before the body which moves along with it, and has been called "The Wave of Translation." This wave, or moving heap of unbroken water, whatever may be the velocity of the moving body that produces it, can itself move only with a given velocity in a canal of a given section, which is proportional to the depth of the canal, and is such that if the section of the channel were rectangular, the wave's rate of motion would be just equal to that acquired by a heavy body in falling through a height equal to one-half the depth of the fluid. Whilever, then, the body or boat moves with a velocity less than, or only equal to, that of the wave of translation, it is retarded by the latter; the force producing motion is, in fact, employed inconstantly, as it were dragging the boat up hill; but no sooner has such a velocity once been given to the boat, that it outstrips the wave, than the latter ceases to oppose its progress, and, on the contrary, rather aids in its motion; hence the value and peculiarity of fly-boats with which all are now so familiar. But the amount of retardation produced by this wave of translation is proportional to its size, which again depends, amongst other conditions, upon the magnitude of the immersed body originating it in relation to that of the canal.

Again, were the section of a canal rectangular, that is, were its depth the same at the edges that it is in the middle, this wave, however large, or however fast it moved, would never break or become a surge, rolling along and injuring the banks; but the section being of most canals a slope to each side, the wave at the edges cannot move as fast in the shallow water as in the centre, and thus continually breaks or topples over, and the destructive effects of this on the banks are easily observable.

Now on a canal of 40 or 45 feet wide, and 7 or 8 feet deep, any vessel of much wider beam or greater draught of water than an ordinary fly-boat, and moving at a considerable velocity, is inadmissible, practically, from

the foregoing reasons. The boat must not be wider, nor can she have a greater depth in the water, and hence cannot carry a greater burden; and as a boat of the dimensions of the existing fly-boats is fully laden with her crew and passengers alone, there remains no room for introducing steam power unless we can obtain a greater buoyancy; but the boat may be longer, provided she can be enabled to pass the locks; and here it is that the invention above alluded to comes to our ai l.

A boat has been built of 120 feet in length, so constructed as to part in two in the middle of her length, so that the two portions lying parallel to each other are passed through a lock of 70 feet in length at once.

The separation and rejunction of the halves of the boat is effected by a peculiar construction and mechanism of great simplicity, which is such that whatever be the difference of draught in each when separate, they are brought to an equal immersion when rejoined, and in fact become one rigid and firm boat.

The separation of the forward and after boats and their rejunction can be effected in about 40 seconds by two men. The forward portion or boat is devoted exclusively to passengers and their luggage: it gives ample accommodation to sixty passengers, with an allowance of one hundred weight of luggage each; and the boat being of wider beam than any fly-boat, enables the cabins to be made very roomy and comfortable.

The after portion or boat is devoted wholly to the machinery for propelling the whole boat when united. This consists of a pair of non-condensing steam-engines, of 30 horse power, with boiler of the tubular or locomotive construction, designed and built by Messrs. John and Robert Mallet of this city, and finished in a very superior style. The engines and boiler, fitted to the proper height, weigh under five tons, and are yet of ample strength to transmit their power to the paddle wheels, which are a modification of Mr. George Rennie's patent, the float-boards being of an oval form, dipping with their points foremost into the water.

The boat is steered by a wheel, placed on the deck, above the engine room, and between the paddle wheels, where the helmsman has a commanding view of all around him. The rudder is of a peculiar construction, placed beneath the keel of the boat, to prevent injury by grounding on the sloping banks f the canal.

Lengthened and careful experiments have been made with this steam boat, as to speed and management, &c., on the six mile level of the Royal Canal—running measured distances. The general result has been, that with a complement of fuel (coke) sufficient for her intended voyage, and with crew and ballast equivalent to her load of passengers, &c., her speed has been between six and seven British miles per hour. She has also been tried in open water, and her speed has been found to reach as high as nine and-a-half to ten miles per hour.

The distance between Killaloe and Limerick consists of about seven miles of canal and five of river navigation; hence her average speed on her intended station will be seven British miles per hour, or rather more.

At six miles per hour she produces scarcely any wave of translation, and no surge is produced by the paddle-wheels capable of injuring canal banks. Altogether, the total amount of commotion in the water of the Royal Canal, which is the same size as that at Killaloe, viz., 40 feet wide, and about 6½ feet deep, is greatly less than that produced by a common fly-boat; thus demonstrating, that the methods which have been heretofore adopted in attempting to avoid the imaginary evils dreaded from the after-wave, or surge of side paddle-wheels, by requiring a great breadth of beam, and large section of immersion, have involved the insurmountable evils of a huge wave of translation, and a resistance to rapid motion increasing faster than it was possible to overcome by any steam power the boat could carry.

These results have been obtained by the narrow beam and great length of the boat, and by the extreme lightness of the boat and engines in proportion to the great power; all former attempts to apply steam power on narrow canals having been made with twin boats, or single boats of wide beam, the greatest velocity ever attained by any of which, on a forty-foot canal, has not exceeded 4½ British miles per hour, and attended with a destructive surge. The facility of management of this boat has been found very satisfactory in the various trials made, particularly in lockage, where the power being in the boat, enables check-ropes, &c., to be dispensed with, and most of the labour of working a passage boat avoided; by reversing the engines, she can be stopped at full speed in her own length.

The consumption of fuel has been found to be 114 lbs. of coke per hour, including that used in getting up steam, and allowing 10 per cent. for interest of capital in boat, complete wear and tear, repairs, wages of crew, &c., the total cost of transit of 60 passengers and luggage, per mile, is ten pence and a fraction, without any injury to the banks, or wear and tear upon the towing paths.

This calculation is on the disadvantageous condition of the boat only going 24 miles per day, or one voyage; whereas, if she was employed fully for 12 hours, the cost per mile would be much less, as the wages, interest, &c., would all remain the same.

The boat is at present receiving her cabin

furniture and fittings, preparatory to assuming her station on the Shannon, to which she will shortly proceed by way of the Grand Canal.

## ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

*** *Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for that purpose.*

ALFRED JEFFERY, LATE OF PROSPECT PLACE, NEW HAMPTON, BUT NOW OF LLOYD-STREET, PENTONVILLE, GENTLEMAN, *for a new method of defending the sheathing of ships, and of protecting their sides and bottoms.*—Petty Bag Office, October 29, 1841.

A solution of caoutchouc is made, either in naphtha, or spirits of turpentine, with which oakum is saturated, and after the superfluous solution is squeezed out, its fibres are separated and dried, when it is to be used for caulking the seams of vessels in the ordinary way.

A mixture is made by dissolving powdered asphalte, or lac, in the naphtha-caoutchouc solution, which mixtures are called No. 1.

A second mixture is made by dissolving corrosive sublimate in white naphtha, and combining therewith either of the former mixtures.

For paying the seams, or coating the sheathing of ships, either of the first mixtures may be used, or for the latter purpose, either of the second mixtures may be employed, being laid on hot with a brush in successive coats, one being dry before another is applied.

The claim is, To the method herein described, of defending the sheathing of ships, and of protecting their sides and bottoms; also the application of caoutchouc, and of lac, for that purpose.

We have seen some specimens of these processes, which looked exceedingly well, but we must confess that the method pursued, appears to us to be of very questionable utility.

MILES BERRY, OF CHANCERY-LANE, PATENT AGENT, *for certain improvements in machinery or apparatus for making or manufacturing nails and brads.* (A Communication.) Petty Bag Office, November 4, 1841.

The improved machinery consists of two levers turning on centres one above the other, connected together at one end by a link, the lowermost being attached by a connecting-rod to a crank, which gives a reciprocating motion to the levers. Two tools or cutters are attached to each of the levers in angular positions, so that by the reciprocating motion of the levers a top and bottom tool, situated on opposite sides of the centres, will meet and cut the strip of metal passed between them, into nails or brads.

The claim is, 1. To the improved arrangement and construction of machinery for cutting nails and brads, consisting of two opposite pairs of cutters, having a reciprocating motion, as described.

2. To shaping the cutting dies or tools of cut-nail machines in such a manner as to enable them to produce nails or brads having heads formed of two projections, cut from the ends or points of the two adjoining nails.

In illustration of claim 2, the reader is referred to the American Patent of Walter Hunt, of New York, an abstract of which, with an engraving, was given at page 336, vol. xxxiv.

EDWARD NEWTON, OF LEICESTER, MANUFACTURER, AND JAMES ARCHIBALD, OF THE SAME PLACE, MACHINIST, *for improvements in producing ornamental, or tambour work, in the manufacture of gloves.*—Enrolment Office, November 4, 1841.

These improvements consist in the application of machinery to the production of ornamental or tambour work on the backs of gloves, and also in the apparatus for holding the cut-out materials for making gloves, whilst they are undergoing this ornamenting process.

The machinery employed for this purpose, as also its action, is of too intricate a character to be intelligibly described without the aid of illustrative engravings; nor is the process one of such general interest as to induce us to devote much space to its explanation.

FRANCIS JOHN MASSEY, OF CHADWELL-STREET, MYDDLETON-SQUARE, WATCH MANUFACTURER, *for improvements in winding up watches and other time-keepers.* Enrolment Office, November 4, 1841.

These improvements consist in a mode of winding up repeating watches by pushing in the pendant, to which a rack is connected, that takes into a ratchet-wheel of thirty teeth on the square arbor of the going barrel.

Each tooth answers to a quarter of an hour, and the wheel is moved round four teeth each time the pendant is pushed in; the watch being wound up by thirty of these motions. After the pendant has been pushed in, it is returned to its place, the rack being kept in action with the toothed wheel by a circular spring, which causes the quarters to be repeated by the return of the pendant.

The push piece of the pendant, (which may be either round or square sided,) works in a socket on the watch-case, a stop on its inner end preventing it from being separated from the watch.

MOSES POOLE, OF LINCOLN'S INN, ESQUIRE, *for improvements in the manufacture*

*of fabrics by felting.* (A communication.) Enrolment Office, November 6, 1841.

These improvements consist in conducting the bat over the surface of a steam chest covered with woollen cloth or other soft substance, between two endless cloths or aprons; and acting upon the bat by a series of surface bars and plate, also covered, and so arranged, that each succeeding bar moves in a cross or opposite direction to the preceding one. The result of this action is, that the fibres of the bat are caused to unite, intermat, and become felted.

Several arrangements of machinery are described for the purpose: the claim is to the mode of manufacturing fabrics by felting, by causing the bats to be operated upon by bars or surfaces, having curved and alternating motions, as described.

JOHN GRAFTON, OF CAMBRIDGE, CIVIL ENGINEER, *for an improved method of manufacturing gas.* Enrolment Office, November 4, 1841.

A double retort is built of fire bricks, in the form of an oven, divided by a transverse partition in the middle; beneath each retort there is a furnace fitted with doors, &c., in the usual manner. The whole of the retort is covered by an arch, which the patentee calls "a heat-retaining arch," furnished with apertures communicating with the flue.

From the retorts the gas passes to what is called "a decomposer," also provided with a heat-retaining arch, and divided into four chambers by longitudinal brick partitions; in the first of these chambers there is a number of transverse metal divisions, which descend to within one-third of the bottom; the other chambers are filled with ignited coke or charcoal. On entering the decomposer, the gas passes through the whole of the chambers by means of openings at either end of the partitions, alternately; and being freed from impurities in its passage, is drawn through the exit pipe attached to the last chamber by an exhausting apparatus. In this pipe there is a shield of fine wire gauze, to prevent accidents from the ignition of the gas as it leaves the decomposer.

The claim is, 1. To the manufacturing of gas in double retorts, arranged in the manner described. 2. To increasing the heat of such retorts by the application of a heat-retaining arch. 3. To passing the gas through a decomposer, either detached from, or combined with the retort. 4. To the application of an exhausting apparatus to the decomposer, to facilitate or compel the passage of the gas through it; together with the wire-gauze guard, interposed in the pipe between the exhausting apparatus and the decomposer.

PHILEMON AUGUSTINE MORLEY, OF BIRMINGHAM, MANUFACTURER, *for certain improvements in the manufacture of sugar moulds, dish-covers, and other articles of similar manufacture.* — Enrolment Office, November 6, 1841.

The nature of these improvements are pretty fully developed by the claims, which are as follows.

1. To an apparatus for holding the plates of metal used in the manufacturing of sugar-moulds, while the edges are being cut into a curve.

2. To an apparatus or machine for bending the suitably formed sheet of metal into a conical form.

3. To the mode of manufacturing dish-covers, when such covers are made of tinned iron, by forming them of two pieces or halves, joined together by a seam or joint in a vertical plane.

4. To the mode of manufacturing dish-covers of German silver, or copper, or an alloy of copper or zinc, by forming each cover from one piece or sheet of metal, by stamping or pressing, in combination with the annealing process.

5. To the mode of manufacturing dish-covers by joining several pieces of metal, or alloys of metal together, so as to produce a fluted dish-cover, the joinings being in vertical planes, as described.

HENRY PINKUS, OF 36, MADDOX-STREET, REGENT-STREET, GENTLEMAN, *for an improved method or methods of applying electrical currents, or electricity, either frictional, atmospheric, voltaic, or electro-magnetic.* — Rolls Chapel Office, November 14, 1841.

On the internal and external sides of a vessel are constructed electrical troughs or cells, in the following manner. On the external side of the ship is laid a surface of pitched or resined felt, and upon that a surface of copper, or other suitable metal; the cells are formed by a series of metal bars, or oak slabs. If of metal, they are to be 2 inches wide, ½-inch thick, and to be sheathed with ¾-inch oak; if of oak alone, 3 inches wide, by 2 inches thick. These, being the first series, are placed about 1 foot apart, in vertical parallel lines from stem to stern of the vessel, and from near the keelson, up to the water line, or above it, and bolted to the sides. The bars must be notched, so as to allow the water to pass from one cell to another. Or, a series of short lengths of wood of the same dimensions must be laid in horizontal lines parallel with each other, from near the keelson, upwards, so as to form square cells 1 foot apart, and notched; over these square cells is laid a surface of zinc, one surface of which, with the copper, forms one cell. Over the whole surface of the zinc is laid and attached a similar series of parallels, and over them another surface of copper. Thus are formed two series of cells, having

zinc and copper surfaces in opposition. And so other additional cells may be formed; or the cells may be so arranged, as that each independent cell shall present two zinc, and two copper surfaces in electric opposition. Over the outside surface must be placed a surface of resined felt, so as to insulate the final metal surface, and on this may be put suitable sheathing.

From the inner side of the vessel there must be a vertical channel near the stem, communicating with all the cells for the ingress of fluid from the supply pumps, and also one near the stern, but opening outside the ship, for the discharge of fluid. The vertical edges of the copper and zinc surfaces for each general cell must be united and joined to a good metallic conductor on the inside of the vessel. The surfaces of the cells on the inside are to be in like manner united, and joined to conductors. Between the decks of the vessel may be placed electrical troughs or tanks, with cells arranged in the common way, but these must have lids, and be hermetically sealed, and have vent-pipes for the escape of gas; they must also be supplied with dip-pipes inserted one-third of the depth of the trough, the metallic surfaces being united, and joined to metallic conductors, as before directed. These troughs are auxiliary, and may be used with varied electrical solutions, so as to combine different electrical elements.'

Within the vessel is to be erected "an electro-magnetic engine of contact" with a flexible armature, or keeper, to the magnets of which the before-named conductors are attached.

The motive power of this engine may be applied to paddle-wheels of the ordinary form, or to screw or other submarine propellers.

In order to put the foregoing arrangement into action, the troughs and cells are charged, the latter with sea-water, and the troughs either with the same or other suitable solution; the metallic circuit being properly arranged, electric fluid passes by the main conductors to the electro-magnetic engine, and puts it in action, thereby driving the paddle-wheels or other propelling agents.

The patentee then describes some improvements in working the electro-magnetic engine, (already described in a former patent, dated Sept. 24, 1840, and noticed at p. 300 of our last volume,) when applied to locomotive travelling, or to canal navigation; and also certain improvements in applying electro-magnetic circuits for the purpose of sealing and unsealing the pneumatic valve therein described. So far, well; or, at least, so far is the subject matter in accordance with the title of the patent; but to this the patentee has appended a *scheme* for propelling ships, having as little to do with "the application of electrical currents," as it has with the motion of any of the planetary bodies in their respective orbits.

A pair of marine steam-engines are placed in connection with the paddle-shaft; but instead of steam being the motive power, condensed air is employed, to obtain which the patentee has hit upon the following contrivance. Behind the engines is placed a supply engine, consisting of two piston cylinders placed lengthwise of the vessel, and fitted with clack valves, as blast cylinders, for compressing or rarefying air; or arranged for forcing water or other fluids. These pistons, by means of cross-heads, side-rods, &c., are connected to an overhead beam; to the main axis of this beam, which passes through both sides of the vessel, and works in stuffing-boxes, is attached one end of a long lever, at the other end of which are fixed hermetically sealed air-tight floats of large dimensions. The float levers work up and down within curved guides attached to the sides of the vessel, having buffer springs at their extremities. At the stern of the vessel, a large float of a circular or elliptical form is connected with a similar arrangement of levers working other "supply engines.'

The rise and fall of the waves of the sea and the consequent motion of the vessel will, it is said, combine to give motion to the floats and levers, which, by means of the supply engines, will force or compress the air into reservoirs to the extent of one or several atmospheres, which, being admitted to the steam-engine cylinders, will put them in action, and give motion to the paddle-wheels or other propellers.

## NOTES AND NOTICES.

*The Styx Steam Frigate.*—The accident which lately happened to the machinery of this vessel has been promptly rectified. A new connecting-rod came down from London on Thursday, and was soon adjusted to its place. On Saturday last the Styx left Portsmouth harbour, at the commencement of the flood tide, and made a trial voyage round the Isle of Wight, performing the distance in six hours, against tide nearly the whole way. The engine was found to be in excellent order, and acted most beautifully, making from 18 to 19 revolutions per minute, with a superabundance of steam blowing off, enough for three or four more revolutions per minute. Mr. Taplin, the Government engineer, attended the trial, and expressed himself highly satisfied with the result. The speed, by log, was ascertained to be full ten knots—that is, nearly 11¾ statute miles per hour—a very excellent speed, when it is considered that this vessel is of 1,100 tons burden, and drawing 14 feet 7 inches of water at the time, and having engines of only 280-horse power.—*Hampshire Telegraph, Nov.* 13.

*Erratum.*—Page 371, column 1, fifth line from the bottom for "tiles"—read "soles."

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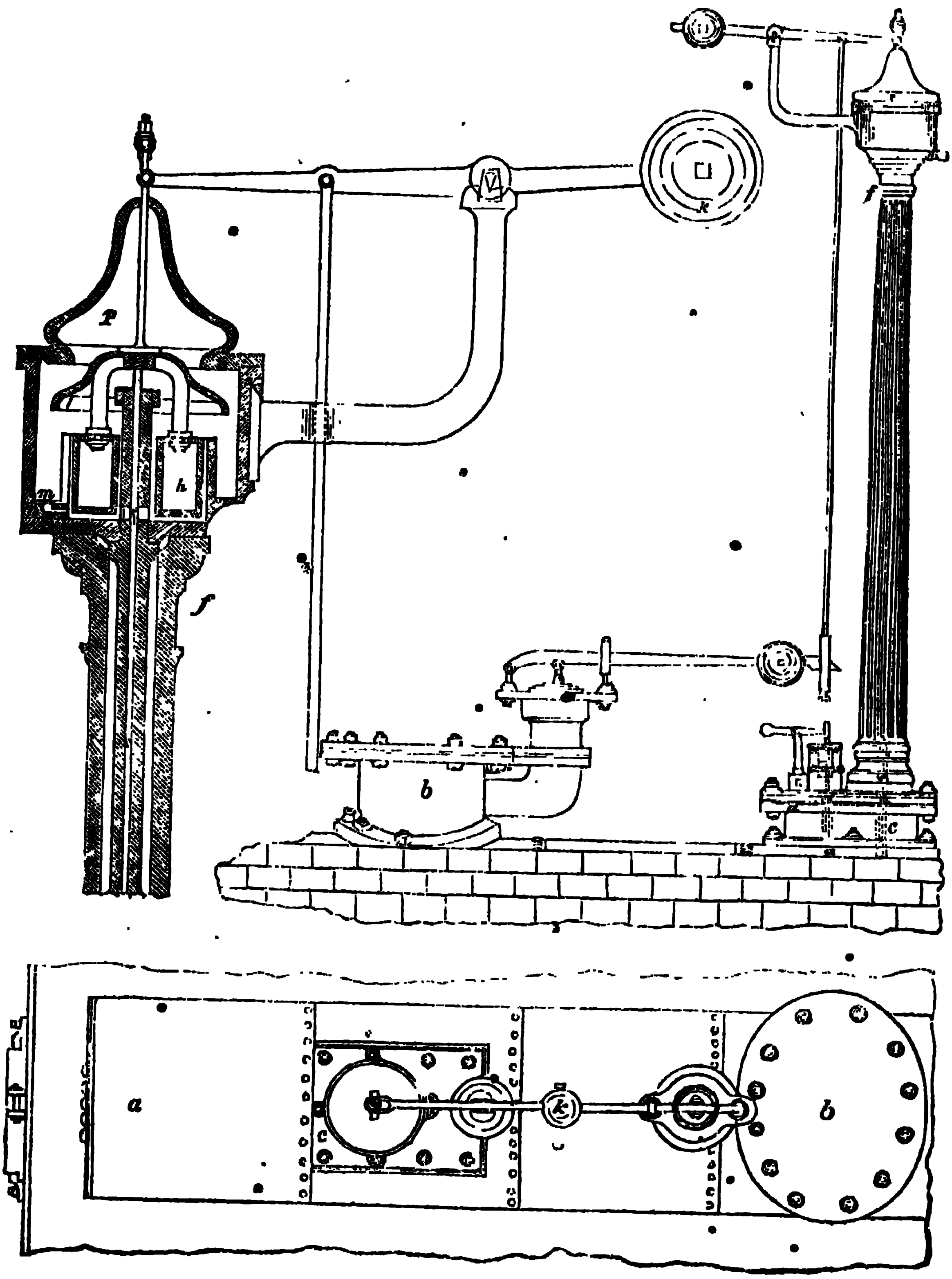
## WILLIAMS'S MERCURIAL SAFETY VALVE.



## DESCRIPTION OF A MERCURIAL SAFETY-VALVE, INVENTED BY MR. OCTAVIUS WILLIAMS, FOR WHICH THE FIRST BRONZE MEDAL OF THE ROYAL POLYTECHNIC SOCIETY OF CORNWALL WAS AWARDED AT THE ANNUAL MEETING OF 1841. BY THE INVENTOR.

A column of mercury is made use of, the height of which will be in accordance with the pressure of steam required for any engine; that shown in the drawing will serve for a pressure of about thirty-six pounds to the square inch. What I consider an improvement, is the application of a column of mercury to a float communicating with the safety valve, the buoyancy of which float will ensure the opening of the valve, when the steam has attained as great a pressure as is consistent with safety, thereby preventing the recurrence of those accidents which are supposed to have originated from the adhesion of the valve to its seat.

When the mercury has reached the top part of the cylindrical vessel containing the float, (supposing the valve not to have previously yielded) it will tend to lift the float, with a force equal to 23 pounds, or about 200 pounds immediately over the valve, by the aid of the lever, and that cannot fail to lift it.

But should it then from some unseen obstacle refuse to yield, the mercury will be blown into the outer cylindrical vessel, giving vent to the steam, which will escape by small holes in the cover or hood, (which is used for the protection of the mercury from dust, &c., and to prevent its being wasted). After the pressure of the steam is somewhat diminished, the valve may be shut and the cock opened, the mercury will then descend through the pipe to its former place; and the valve may then again be opened.

I have said the mercury will fall again as the valve is shut, on the supposition that the remaining steam will condense on the supply being cut off: if this is not found to be the case, a small cock must be added to the mercury box to allow of its escape.

A small quantity of mercury will be found sufficient for such an apparatus. A column one quarter, or three-eighths of an inch in diameter will be found as efficient as a larger one; also the cylindrical vessel which contains the float need not exceed the float in diameter more than three-sixteenths of an inch, the tendency of the float to rise, when encircled by that portion of mercury, of course being the same as if it were surrounded by a larger quantity.

*Explanation of fig.* 1.

*a*, part of the boiler, enclosed by brick-work, &c.

*b*, manhole, on which stands a common safety valve.

*c*, cast-iron box, containing the mercury which is acted on by the steam from the boiler, admitted by the small valve *d*, and forced up a wrought iron-pipe *e*, of small bore, (which is enclosed and supported by the cast-iron pillar *f*,) then through the holes *g*, to act on the lower surface of the float *h*, contained in the cylinder *i*, which exceeds the float in diameter by about one-quarter of an inch. This float is counterpoised by the weight *k*, and acts by the intermediate levers on the safety-valve, which it lifts when the steam has attained a pressure corresponding with the height of the wrought-iron pipe. If the valve should not yield to the united forces of the steam under the valve, and of the mercury under the float, the mercury, on the steam rising still higher, will be blown through the wrought-iron pipe *e*, against the part *l*, and thrown into *m*, where it may be allowed to remain until the steam has somewhat decreased in pressure; it may then by opening the cock *n*, and shutting the valve *d*, fall into the cast-iron box as before. When the mercury is blown out, the steam issuing from the pipe and escaping by small holes in the cover *p*, will make sufficient noise to alarm the engine-man.

## PREVENTION OF RAILWAY ACCIDENTS.

Sir,—The late lamentable loss of life on the Grand Junction Railway, renders it very desirable that some plan should be adopted, whereby the recurrence of similar accidents may be prevented. In furtherance of this object, allow me to

suggest, through the medium of your widely-circulated Journal, whether a screen or fender of sheet iron, or strong open wire-work might not be attached to the foot-boards and sides of railway carriages extending to the front of the buffers and to the level of the rails, so as to effectually partition off the wheels from contact with outward objects. These fenders, or screens, might be made portable if desired, and the best mode of attaching, and detaching them would readily suggest itself to any person conversant with the manner of affixing the usual wheel guards to private carriages. Had such guards been in general use there is little doubt that the valuable lives lately lost by being run over on the Grand Junction Line, would have been spared, with many others which will readily occur to the recollection of those of your readers at all acquainted with the chapter of accidents arising from railway locomotion.

I am, Sir,
Your very obedient servant,
THE BLACK DIAMOND.

Kilburne, near Derby, November 11, 1841.

## MR. PRATER'S ESSAY ON THE INHERENT ACTIVITY OF THE ATOMS OF MATTER —REPLY BY MR. PRATER TO MR. WIGNEY, PRINCIPALLY IN REFERENCE TO THE CAUSE OF THE EVAPORATION OF FLUIDS IN VACUO.

Sir,—I beg to enclose a communication for your Journal. I think any one who reads it will be convinced that I have not shrunk from a full investigation of the point that may seem to go most against my theory as regards fluids; and that I have even supported Mr. Wigney's theory by quoting Sir J. Leslie's Experiment, when I might quietly have passed this over, and left Mr. Wigney's theory to remain a mere theory, for, as far as I see, he *himself* has adduced no *experiment* in its support. I have to thank him, however, for leading me into still deeper reflection on the subject; as my aim in writing the Essay in question was not merely to satisfy superficial readers, but to give to the world something that might aspire to a permanent place in the Annals of Philosophy. Whether I have succeeded or not, is not for me to decide; but I shall content myself with the hope, that in the discussion I have endeavoured to prove that I consider his the preferable mode of warfare in science, who, by comprehensive views of a subject, aims rather at bringing to light the *truth*, than in putting in the most attractive form his own peculiar views.

I am, Sir, yours very obediently,
H. PRATER.

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Sir,—In your Number just published, (No. 952,) I see Mr. Wigney is dissatisfied with the note to my Essay on Inherent Activity, on the ground that I have not done him justice. Now, in order to show that I have done him justice, I shall quote *his own exact words;* otherwise, in a controversy like the present, in the *void*, as it were, between physical and metaphysical science, it is ten to one that he puts a wrong construction on my words, which, as Locke says, are often the cause of people *not* understanding one another. But, before commencing my quotations, I must beg to say, that as Mr. Wigney's first critique on my Essay, in which I said nothing of his opinions, (being unacquainted with them,) was in an unnecessarily caustic tone, so I find his last to be still more so, and but for his play upon words at the commencement of his letter, coupled with a passage which I shall soon quote, towards the middle, which makes me really think he considers I have not done justice to his *theories*, (for, as I before said, I see not a single one supported by experiment,) I should have said nothing more on this subject in reply to him, or have inquired his meaning as to my conduct in the discussion being "more ingenious than ingenuous," as he terms it. As, however, that Essay cost me a great deal of thought, and a considerable number *of experiments*, in the following observations I shall endeavour to steer as clear of personality as I can, with one who has commenced it, and labour only for the establishment of what I still conceive to be a truth in physics, *supported by experiments.*

The passage which I have already promised to quote is the following:—

"What I conceive I have just reason to complain of in Mr. Prater's note is, that he has endeavoured to make it appear as if I

had expressed an opinion that the addition of heat to matter is always the cause of its motion; and by withholding much of what I did state, has left the inference to be drawn that I conceived the impartation of heat alone was the cause of the motion of matter."

Now although this paragraph seems rather obscure, yet I conceive it to mean that I have done injustice to Mr. Wigney's views by an act of omission, "by withholding much of what he did state." Now I must beg to say, I wrote the Note to my Essay at Geneva, merely from memory of what Mr. Wigney had objected to in my Essay, and consequently without consulting his writings on the subject. However, since my return to England, I have looked over other letters in your magazine by Mr. Wigney on the same subject, and also others in reply to an anonymous correspondent, ("A. Y.") and I now shall confess that these letters have appeared to me very unsatisfactory and almost unintelligible, being filled with metaphysics and gratuitous suppositions, *where experiments were possible.* As Byron, however, "had no genius for friendship," so I may have little for understanding Mr. Wigney's abstruse speculations, ("*Non omnia possumus omnes,*") and I therefore leave them to the judgment of the public. So much for showing there may be some excuse for my not having alluded to these letters in my Note to my Essay. I therefore assert, that in that Note I did not intentionally omit any of Mr. Wigney's opinions that might seem to go against me; and I assert further, that after having looked more into those opinions since my return to England, I have nothing more to say on them, or any alteration to make to my Note, already among the pages of your really practical journal.

Let us now get to the other meaning in the above quotation. Mr. Wigney also means to assert that he admits that heat is not the sole cause of motion in matter. Now all I can say is, that *if* Mr. Wigney can show that I have directly stated, or by silence, ("omission,") attempted to make your readers believe this, I confess I have been in error, and now confess such error. But this censure, on his part, seems to me to have nothing to do with the points of discussion. What cause, I will ask, has Mr. Wigney assigned for the diffusive power of gases? As far as I can understand him, not their *latent* heat, as I ventured to conceive possible in my Note, *but an actual impartation of heat,** and the same for the motion of water in the void, and the motions of powders, &c., discovered by Mr. Brown. Let us grant then, that Mr. Wigney allows that there are other causes of motion than heat, as all mankind do, (for who doubts that electricity is also a cause of motion?) and what does his argument gain? Nothing that I can see; and for what reason? Because, as far as I understand him, *he has not assigned any of these causes to explain the facts pointed out in my Essay.* He has not, as far as I understand him, ever attributed them to the *latent* heat of matter, but to the diffusion of heat, or some term that made me conceive he meant the *impartation* of heat. If he can show that he meant by diffusion of heat, latent heat, then I shall say that he has anticipated me in the remarks contained in my Note to my Essay. I do not believe, however, that he can prove this.† But let us conceive, even, that he can, does my Essay fall to the ground? I conceive not at all, as to its *main* object, viz., the real cause of the motion of gases in contact. As they move, diffuse, without being heated, and as water rises in the void, &c., motion is still an essential property of matter *in minute state of division, or when freed from the power of cohesion:* in masses I allow its inertia. The Note to my Essay is as purely metaphysical, as Mr. Wigney's writings; it only

* In order to do justice, I have again turned to his letter on this subject, (*Mech. Mag.*, October, 1840,) before printing this communication. At p. 406, he says on this subject, "I (Mr. Wigney) endeavoured to account for the amalgamation on the principle of affinity subsisting." To pass over the impropriety of using the word amalgamation here—never applied, except to the combinations of mercury—it here appears that he attributes the diffusion to "affinity;" but chemists do not admit any affinity in the case. Further on, in the same place, he says, "I am decidedly of opinion that heat is an accessory cause," &c., &c., not giving the least idea to believe he meant *latent* heat, which he probably did not.

† Should Mr. Wigney think fit to make the attempt, I beg to state, as far as I am concerned, that I should never admit he had proved his point, unless he *quoted* from some of his own previous writings to show that by diffusion of heat, he always meant latent heat. *Quotations* would in this case be necessary, a plan the reader will see I have adopted myself to establish my claims, both in the Note to the Essay, and also in the Essay itself. —Quotations and experiments—in short, *facts.*

asserts what seems to me a *probability*, that latent heat is the cause of the motion in question. But it may be that electricity, modified by latent heat, is the cause of inherent activity. Here, all we can attain to seems probability, and therefore, if Mr. Wigney thinks he was the first to start this *opinion*, I am willing to yield the point, contenting myself with what I consider the most important and original view on this subject, viz., that water evaporates in vacuo, and gases move through each other, in consequence of the *general law* that matter, in a minute state of division, unrestrained by cohesion, has inherent activity as an essential property of its existence. And I maintain that there is nothing at all inconsistent with this view expressed in my Essay, and the one in the Note to it, viz., that latent heat may possibly be the cause of this inherent activity. Mr. Wigney, indeed, says he sees some; I do not. The Essay is on the cause of motion, and is practical;—the Note is on the cause of this cause, (so to speak,) and being an attempt to ascend a scale higher in causation, goes into metaphysics, and is purely theoretical, and put forward by me as a probability only.

During my stay abroad I looked attentively at all the more recent discoveries and experiments made on the Continent in reference to my Essay, and found a paper in the *Annales de Chimie*, by M. Gay Lussac, on driving off the carbonic acid from chalk by heat, which appears to me to confirm the views taken in the Essay.* This eminent chemist states from direct experiment, in reference to the reason why you can so much more easily drive off the carbonic acid from chalk (turn this into lime) when the chalk has been previously moistened, that a current of air has an equally good effect, and consequently, he thinks that moisture, like a current of air, may act by tending to form a vacuum; thereby admitting, that a void has the power even of assisting heat in decomposing matter—*i. e.*, in bringing its latent power of "inherent *activity*" into play.* Now a void should have this effect in all cases, if I have taken the proper view of the subject. If Mr. Wigney will institute any *experiments* which show that a void in many cases has not this power, then I shall feel bound either to give up my theory, or to explain such experiments on other principles. And here I may observe, that sometimes other principles seem adequate to remove apparent objections to the theory, as in the following:—

Sir J. Hall discovered that you may fuse chalk, if it be surrounded with an atmosphere of carbonic acid gas. The carbonic acid gas, in this case, then, is not driven off—lime cannot be made in such circumstances—because it is a property of chalk to *fuse;* and thus, in all probability to have its affinity for carbonic acid gas increased, in such circumstances. If the chalk had not fused when surrounded with an atmosphere of carbonic acid gas,† this might have been, to a trifling degree, against my theory, but not to a great extent, *because so much heat is employed.* The experiments by which the theory of inherent activity would be upset, must be made at low temperatures; in short, by the air-pump *void.* And this remark brings me to the paper (*Mec. Mag.* No. 905) of your correspondent "A. Y.," in reply to Mr. Wigney, where an experiment is related, and consequently *something tangible* is put before us. This ingenious, and to me

* I may also here state, that I saw an abstract from a paper in the *Bibliothèque Universelle*, in which it was affirmed, that a German chemist had lately repeated Mr. Brown's experiment of the powders, enclosing the mixture between a concave and flat piece of glass *well ground*, so as to prevent all evaporation, currents of air, &c., and yet the molecules of the powders moved as usual. A refutation this of Tiedemann's opinion, that the motions probably arose from the causes just named. (See his Physiology, where he admits the reality of the motions, and that they took place when the water was covered with oil, as in Sir D. Brewster's experiments.) It is right, however, to say, that Tiedemann merely gives it as an opinion,

* *Annales de Chimie*, tome 63. It is here sufficient for my purpose, that M. Gay Lussac should admit, as he does in his paper, that any cause tending to produce a void, favours the escape of the gas: but it seems not improbable that moisture may act as it does when common salt rises by evaporation with sea water, (see Liebig's Organic Chemistry,) viz., by the *physical force* of the vapour drawing it up. I put this, however, merely as a conjecture; for Gay Lussac's explanation may be the correct one.

† I believe it is generally supposed that an intense heat is required to fuse chalk even in this way. This, however, is an error. About two years ago, I fused chalk at a heat certainly below whiteness, by putting pieces of wood, or charcoal, in nitrate of potass, and covering the mixture over by chalk tightly pressed down. An experiment I have not had time to publish hitherto in detail.

more intelligible writer, seems to have found, that when a thermometer, cooled below the temperature of the surrounding air, is put into an exhausted receiver,* that the mercury "rises to the same point, and is subject to the same fluctuations as take place in the external air." (p. 553.) Now to apply this fact to the evaporation of water in vacuo—the point on which, in my Essay, I have been obliged to insist the most as regards inherent activity in fluids (confessed to be *far* less than in gases). This experiment shows that *no* SENSIBLE *heat is imparted to water when it evaporates in vacuo.* Hence the cause of its motion is not so much the impartation or diffusion of heat, as Mr. Wigney seemed to imagine: but rather a power in itself of inherent activity, as I conceive. If Mr. Wigney, or any one else, shall say—"Yes, but it gains heat from the glass or the vessel containing it, &c., which heat immediately becomes *latent*," I shall be ready to agree with them, because I can bring forth an *experiment* to prove that it must become so. How else could water be frozen in vacuo (as in Sir J. Leslie's elegant experiment) *by its own evaporation?* Thus, when vapour is formed, even at the lowest possible heat, it still will abstract heat from the water below it, *otherwise we have every reason to believe it could not become vapour.*†

But admit all this, and I do not see I have any reason to change the opinion already first expressed in my Essay, viz., "But as a fluid must probably move *per se, before* it changes into vapour (when in the void), I must still regard fluids in vacuo, as *per se,* possessing inherent activity." (Note, page 515, *Mec. Mag.* No. 870.) The reader of the Essay alluded to will see, that I make the inherent power of motion in fluids rest, I may say, *entirely* on their evaporating in vacuo; and in that Essay I have always allowed them to have an infinitely less degree of such power than gases and vapours have. But now, then, more expressly to the point. Whether we must admit inherent activity to fluids, as well as vapours and gases, all depends, *as I said in the first part of the Note just quoted,* whether in the void it is *vapour* that moves first, or the fluid itself. (Note, p. 515.) But the case seems this. The void gives the *first* impulse to the motion. The *fluid,* so placed, must tend to separate from a part of the fluid in the vessel—*must first move by its own power;* and as it cannot move to any great extent without attracting more heat, and thus becoming vapour, it draws such heat from all surrounding media. Therefore, the fluid may be said to change itself into vapour on purpose to move; so great a tendency has it to this state of motion, when not pressed upon by the air. Such seems to me the real state of the case: and under such circumstances, I cannot but regard the fluid rather as *moving by its own power,* than as *being moved* by the heat it draws from surrounding media. But whatever view different people may take on this point, Mr. Wigney, and other critics, should never forget, that my Essay is more expressly on *Gases, and the cause of their motion,* which certainly is not any *impartation* of heat; which no doubt *assists,* but in my opinion, does not cause even the motion of fluids in vacuo. And I think this view of the subject is much confirmed by the experiment of "A. Y.," which would seem to make the temperature of the void the same as that of the surrounding medium. It consequently follows, that the water does not *begin* to move in consequence of any unequal distribution of heat, which we know is often an extraneous source of motion in matter. Even the power which water must have in this case of *drawing heat to it* at the commencement of evaporation, shows an *active* force to exist in the water. The heat *subsequently* flows

* This experiment is almost proof of heat being matter, and not mere motion; otherwise how should it exist the *same* IN VACUO, as in the surrounding medium? I say almost proof, but if it be repeated with the same result, on as good a vacuum as can be made, I should consider it absolute proof. I have not leisure just now to repeat it, having other chemical papers in hand.

† Nevertheless, is not the *latent* heat of vapour formed in vacuo, infinitely less than that of vapour formed at higher temperatures? I should think so; and if this be true, Dr. Black's theory of latent heat will surely require modification. But I leave this point to be settled by the experiments of those who are engaged on investigations on heat. In fact, for what we at present know, it may not be *impossible* that vapour may in *some circumstances* be formed in vacuo, from water, without drawing any heat at all from surrounding media; but I do not think this is probable. Nevertheless, it is not likely it can get 1,000 degrees, *or any thing like it,* (Black's Latent Heat of Steam,) from the surrounding media.

to the water, no doubt from the still more active power of motion which this imponderable fluid possesses. But I believe the water *begins* the action, and until some *experiments* are brought forward to prove me in error on this point, I shall hold to the opinion as the more probable.

I now come to another point which I see, after all the above was written, (otherwise it would have been alluded to before,) mentioned in Henry's "Chemistry," vol. i., p. 107, viz., that in Leslie's experiment "if the vacuum be kept up, the *ice itself* evaporates." Now this remark leaves no doubt in my mind that we should regard the water in vacuo as beginning to move, even before it can have gained enough heat to change it into vapour; it also will convince us that heat has less to do with motion, even in this case, than I might have acceded to Mr. Wigney, and yet kept the bulk of my Essay (viz. as regards gases) untouched by any such criticisms. It should not be forgotten, that a *solid* here moves, and *a solid at the temperature of* 32°, *perhaps even lower*, or if not a solid, (to give our opponents the best state of the case for them,) a vapour that is, in fact, rather a fluid than a vapour.

Again, Mr. Faraday found gold leaf might be coated with mercury placed out of contact and below at the ordinary temperature of the air. A friend of mine informed me he had done the same easily under the air-pump, and I have no doubt it might be done, so placed at the *freezing temperature*, since ice evaporates.

Again, Liebig, in his "Organic Chemistry," says, boracic acid and common salt evaporate, and appear in the vapour that rises from their solutions. Now, in this case, solids move, even in the open air. How much more readily, then in the void! You may say, to be sure, the vapour *draws* them up; but I believe they would not want drawing at all in the void, (for there is no doubt that so circumstanced, the particles of almost all solid bodies would sooner or later break the restraint of cohesion, and move through in *very* minute quantities, no doubt, in some cases. Yes, I review the whole of nature, and I see motion in every part. Motion, to be sure, particularly in gases, but still not wanting in fluids, nor even in solids. "Still it moves,"* as Galileo said in his dungeon, even of the earth itself; that stupendous mass, on which, when unaided by science, we tread with the firmest assurance that it is in an eternal state of repose and quiescence.

Let me now again return to Mr. Wigney's last epistle, which has been in a measure forgotten as to its details in the general, and, I hope I may say, comprehensive view I have just been endeavouring to take of the subject before us. Again, then, let us adhere to the method of *quotation*. Mr. Wigney says, he thinks that by my Note I "meant to convey the idea that I (always, even in my Essay) attributed the motion of such particles of matter to the impartation of heat, or to the residence of latent heat among the constituent atoms of bodies." Now I cannot make this quotation without retorting the charge against me in Mr. Wigney's last Note, of "*ingeniousness* or *disengenousness*"—or ignorance, or perversion of ordinary scientific precision, whichever it may be. "The impartation of heat, or the residence of latent heat!" Why the express object of my Note is to draw the distinction between the two; and to show that the motion in question may *possibly* depend on *latent* heat. If I had in the Note ascribed it to the *impartation* of heat, I should at once have admitted myself a convert to Mr. Wigney's views as understood by me. And I cannot pass over this occasion of stating, that Mr. Wigney would do well to remember, that *free* heat, *latent* heat, and *specific* heat, are all used by philosophers in a somewhat different way: and in my Note I *purposely* stated which I meant, in order to avoid being misunderstood, or to induce the belief that I had changed my opinions.

And now, Mr. Editor, I leave my Essay, with its accompanying Notes to its fate; fully satisfied in my own mind, that the explanation such a view affords of the cause of the diffusion of gases is equally satisfactory, as most of the causes usually assigned for the production of effects. It is indeed possible, in the progress of science, that by further experiments, some electri-

* *Pure si muove*

cal, or other peculiarities between gases that diffuse the most readily may be pointed out; but this has not yet been done, and until it is done, I shall rest satisfied with my theory. I repeat, the subject may be elucidated by experiments; and I shall never make a reply to mere hypotheses, still less to personalities.

I am, Mr. Editor,
Yours very obediently,
H. PRATER.

November 8, 1841.

P. S. Since, on further reflection, it is doubtful whether I have so distinctly stated as I should have done, that Mr. Wigney attributes the evaporation of water in vacuo to the *impartation* of heat,* and since Sir J. Leslie's experiment seems to me to give some degree (and only some degree) of support to such a supposition—for, as far as I see, Mr. Wigney has neither brought forward an experiment of his own, nor of any other person in favour of this theory!—I make this postscript to give Mr. Wigney what degree of merit may be due to such a suggestion or conjecture. At the same time I must state, that this matter is by no means yet clearly established, because "ice itself evaporates in vacuo." This would lead us to believe that water *can* evaporate in vacuo, merely *as water*, and without taking any more heat from surrounding matters—without, in fact, any more heat than always must exist in water, while it remains water—without, in fact, any *impartation* of heat.

As Mr. Wigney has undertaken to criticise my Essay, the *onus probandi* of settling this point *by experiment* rests with him. And even should future experiments show there always *must* be (*for it is not enough to show there commonly is*) an impartation of heat, even when ice evaporates, (surround the receiver with ice when the weather is coldest, and how is it then?) the other objection in the present communication will yet remain, viz., that the water *begins* the action of attracting heat. The *impartation* of heat, then, *at best*, can only be said *to assist* in causing evaporation. Further experiments, may, indeed, prove that evaporation can take place, even without such assistance. H. P.

* I have not space in a P. S. to quote his words as usual; but I understand him in this passage.

## REMOVAL OF THE SUNDERLAND LIGHT-HOUSE.

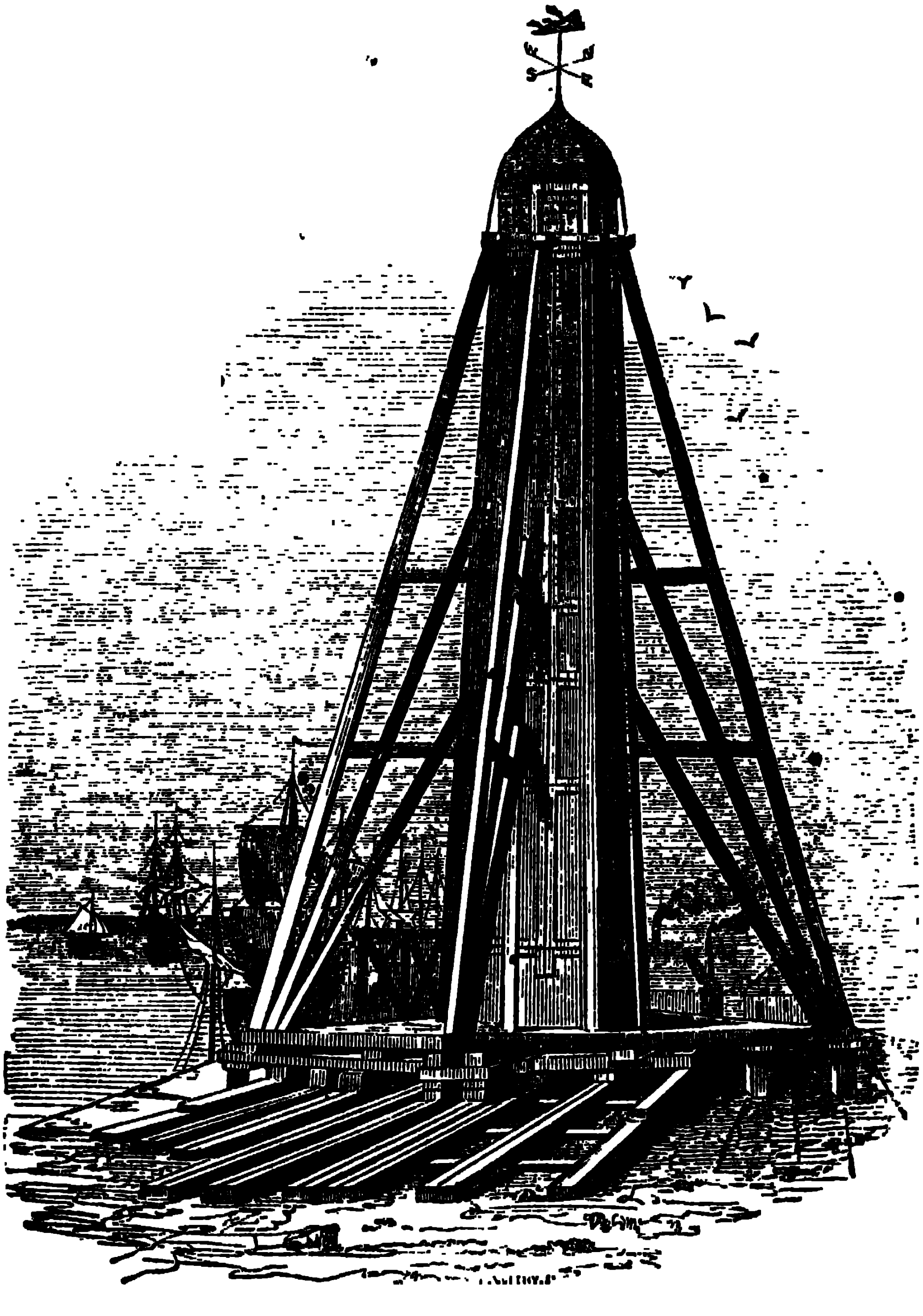
We mentioned some time ago (vol. xxxv., pp. 7, and 192) an extraordinary contract which Mr. John Murray, C. E. had made with the Commissioners of the river Wear, to remove, bodily, the Light-house from the North Pier of the Harbour of Sunderland, to a distance, eastward, of 500 feet. For the following additional particulars, and the accompanying engraving of the tower, taken while *in transitu*, we are indebted to the *Civil Engineer and Architect's Journal*.

"The removal from the North Pier was commenced on the 2nd of August, and transplanted to the eastern extremity of the pier, a distance of 500 feet, and placed upon its new foundation on the 30th of September last, and all the work is to be completely finished by the 2nd instant, (November,) the whole period occupied being only two months.

"The following is the plan submitted by Mr. Murray to the commissioners of the river Wear in May last, when it was under their consideration to pull down, and re-erect the light-house on its new site:—'The masonry was to be cut through near its foundation, and whole timbers were to be inserted, one after another, through the building, and extending 7 feet beyond it. Above, and at right angles to them, another tier of timber was to be inserted in like manner, so as to make the cradle, or base, a square of 20 feet, and this cradle was to be supported upon bearers, with about 250 wheels of 6 inches diameter, and was to traverse on six lines of railway to be laid on the new pier for that purpose. The shaft of the light-house was to be tied together with bands, and its eight sides supported with timber braces from the cradle upwards to the cornice. The cradle was to be drawn and pushed forward by powerful screws along the railway above mentioned, on the principle of Morton's patent slip for the repairing of vessels.' The project was approved of, and the necessary arrangements made for carrying it into effect, the only deviation from its plan being, that during the progress of the work a windlass and ropes, worked by 30 men, were substituted for the screws. Not a crack nor appearance of settlement is to be found in the building.

"We have been favoured with the following communication from Mr. Murray, by which it will be seen that the under-setting of the foundations is perfected.

"'Sir,—In reply to your communication respecting the removal of the light-house on the north side of the harbour, I have to state that since it has been brought to its new site, I have drawn



out the timbers upon which it was conveyed, and the base on its southern side has been underset with two pillars of solid masonry. I am proceeding to do the same on its northern side, preparatory to striking the supporting braces of timber, which probably may occupy another fortnight.

"'The light-house was erected in the year 1803, by the late Mr. Pickernell, then engineer to the harbour commissioners. It is wholly composed of stone; its form is octagonal, 15 feet in breadth across its base, 62 feet in height from the surface of the pier to the top of the cornice, where it is 9 feet in breadth across, and the top of the dome is 16 feet above the cornice, making a total height of 78 feet; and its calculated weight, including the cradle and supporting timbers is 320 tons.

'I am, Sir, your obedient servant,

'JOHN MURRAY.'

"'Sunderland, October 18, 1841.'"

## ON INCREASING THE EVAPORATIVE POWERS OF BOILERS. BY C. W. WILLIAMS, ESQ.

Sir,—In my last communication I gave a further illustration of the increased power of evaporation which may be imparted to any given surface of the flue plate of boilers. I also pointed out the importance of increasing the conducting power of that portion of the flue which is exposed to the greatest heat. This latter branch of the subject, hitherto so wholly overlooked, I now propose considering. The diagrams on the next page are intended to exhibit the value of bearing in mind the relation between the capability of conducting, or transmitting heat, and the extent to which we bring it into action.

Fig. 1,[a] is a plan, and fig. 1,[b] a section of two boilers A and B, united by their internal flues; the former being furnished with the conduction pins, as already explained in my last papers, (see Nos. 951 and 954,) and the latter having plain surfaces. In this experiment, the conduction boiler A, being nearest the flame, and receiving the greatest heat, evaporated, with the same heat and in the same time, 7 lb. 15 oz. of water, while the plain boiler B, being in the second place, evaporated but 8 ounces. This great difference is remarkable, and forcibly illustrates their comparative evaporative values. In fig. 2,[a] (a plan), and fig. 2,[b] (section), the boilers are merely reversed as to position; B, being in this case, nearest to the flame, and A, in the second place, and more distant. Yet, although the heat and times were the same, and with exactly the same amount of heating plate, the plain boiler B, evaporated 5 lbs. 7 oz.; while the conduction boiler A, though farthest from the flame, evaporated 2 lbs. 0 oz. Thus, in the first instance, the boiler A surpassed the boiler B, as 7 lbs. 15 oz. is to 5 lbs. 7 oz.; and in the second experiment it surpassed it as 2 lbs. is to 8 oz. Here we see the value of increasing the heat-transmitting power, or capability, in proportion as we increase the heat to be transmitted; for, had we not done so, it is manifest that the heat which effected the difference between the total weight evaporated 8 lbs. 7 oz. and 7 lbs. 7 oz. (say one pound weight), would have been lost. This experiment is practically valuable, as it suggests the mode of constructing boilers so as to turn to account the entire of the heat obtained in the furnace.

We here see that with the same expenditure of fuel, and the identical same boilers, we are enabled, in the same time, to evaporate by one arrangement, 8lbs. 7oz. of water, and by another arrangement, but 7lbs. 7oz., being an increase of above 13 per cent on the evaporative effect. Now we cannot doubt that this great difference, and in so small a boiler, is exclusively attributable to having called the conducting power more directly into action.

The several columns of figures below the engraving refer to the thermometers above them. One thermometer is placed in each boiler, open at top, and one in the flue at the end of each boiler; and thus, while the temperature of the water is ascertained at the time each five cubic feet of gas are burned, so also is the temperature entering in, and departing from each boiler.

Before making the experiment described in this paper, I had calculated on the gross weights evaporated being the same in both cases, seeing that the heat conducting powers and surfaces were the same. The thermometers, however, tell us the true state of things, and fully explain those otherwise anomalous results; for by comparing the numbers in the left hand columns of both experiments, and which give us the temperature of the escaping gases, we find the former invariably ranging about 25° below the latter, thus indicating that such was the greater quantity of heat transmitted and absorbed, and which produced the increased amount of evaporation. The study of these comparative tables is very instructive, and throws much light on the subject.

And here I would observe on the utter inutility of experiments on heating or evaporating, unless due attention be given to that which hitherto has been so neglected, namely, the quantity of heat escaping by the chimney shaft. For let us suppose an analogous case: —suppose that in testing the power of different kinds of fuel, or evaporative pans, we so mismanaged any of the processes, that a large quantity of the liquid operated on, was allowed to boil over, and be lost, would it not be absurd to affect drawing accurate results

Fig. 1, [a]

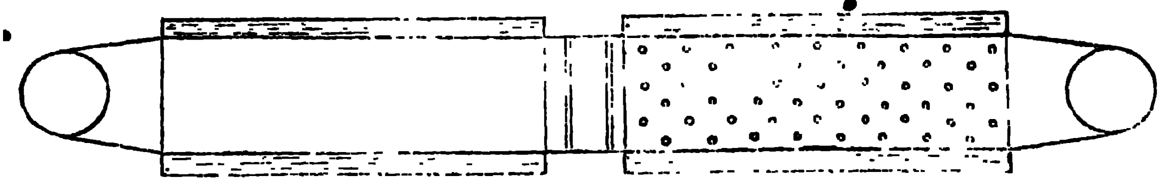
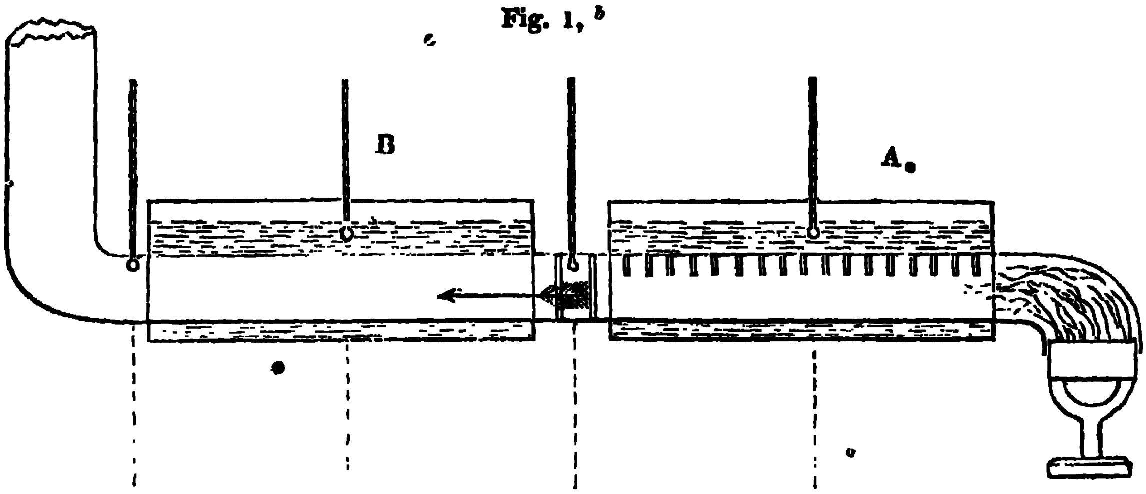


Fig. 1, [b]




| Heat escaping in flue. | Water. | Heat in flue. | Water. | | | |
|---|---|---|---|---|---|---|
| 56 | 56 | 56 | 56 | temperature at beginning | | |
| 154 | 76 | 230 | 146 | after | 5 | cubic feet of gas |
| 172 | 88 | 256 | 170 | " | 10 | [was used. |
| 174 | 91 | 264 | 176 | " | 15 | " |
| 188 | 102 | 265 | 182 | " | 20 | " |
| 188 | 104 | 266 | 182 | " | 25 | " |

Fig. 2, [a]

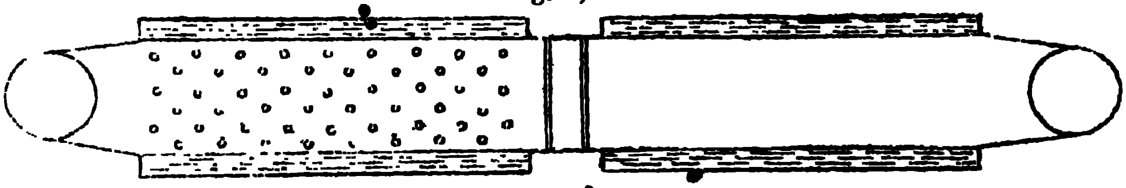
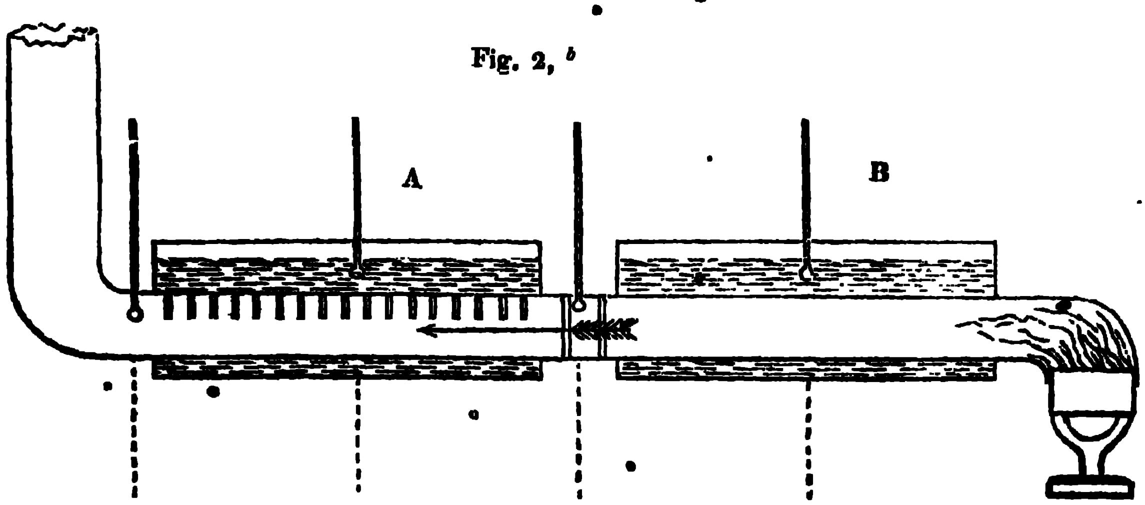


Fig. 2, [b]




| Heat escaping in flue. | Water. | Heat in flue. | Water. | | | |
|---|---|---|---|---|---|---|
| 58 | 58 | 58 | 68 | temperature at beginning | | |
| 180 | 120 | 348 | 158 | after | 5 | cubic feet of gas |
| 190 | 124 | 374 | 162 | " | 10 | [was use]. |
| 200 | 133 | 374 | 164 | " | 15 | " |
| 202 | 134 | 374 | 164 | " | 20 | " |
| 204 | 134 | 374 | 164 | " | 25 | " |

by merely weighing and comparing the respective quantities remaining in the vessels? Yet this is what we daily witness when tables of evaporative results are given, without taking into consideration the amount of the products lost by their escape through the chimney. Before, however, we undertake to give comparative results, our first object should be to have the process of combustion as perfect as possible, so as to generate as much heat as the fuel may be capable of producing: and, secondly, to perfect the conducting and transmitting power of the boiler to such an extent, that no loss, escape, or waste of heat shall take place. Then and then, only, can we produce results which can lead to practical improvement.

Let us then lay aside the system of endeavouring to predicate the evaporative power of a boiler by mathematical calculations, based on the number of square feet of surface plate, or area of fire-grate, while we are yet ignorant of the heat transmitting power which may be given to any required surface, or the effect which any given size of furnace may have in aiding or marring the processes of combustion carried on in it. Let us look to chemistry for chemical results, and consult the works of the able writers of our own day for the details of the difficult and involved process of combustion, rather than of those who affect to resolve the whole into a mere mathematical calculation without even a reference to the quantities or temperature of the materials we employ.

I would here refer to a question which has been repeatedly put, with reference to the metallic conductors above alluded to, namely, will not those conductor pins burn away? This leads, practically, to one of the most important considerations as regards the durability of boilers, and their liability to burn in the parts most exposed to heat: on this head, there appears to be some prevailing, but erroneous notions afloat. In my next communication I propose examining this part of the subject.

I am, Sir, yours, &c.,

C. W. WILLIAMS.

Liverpool, November 22, 1841.

MECHANICS' ALMANAC, AND ENGINEERS' YEAR BOOK FOR 1842.

Of an eminently useful character as this Almanac has always been, it has never exhibited a happier degree of adaptation to existing wants and passing circumstances, or more vigour and freshness, than in the annual number of it now before us. Besides all the customary lists and tables, it contains original articles on the following interesting questions of the day; "Importance of Education to Working Men," in which the arrogant dogmas on this subject of Mr. Brunel, engineer to the Great Western Railway, are very cleverly exposed,—"The Corn Laws," demonstrating their destructive operation on the arts and manufactures of the country,—"Effects of the Price of Food on the Rate of Wages," in which it is clearly shown that wages *do not* rise and fall with the price of food,—"The Practical Difference, or Natural Consequences of the Monopoly System,"—"Necessary Connexion between the Price of Food and the Progress of Pauperism,"—"Exportation of English Machinery, and Progress of Foreign Machine making," an Analysis of the last Parliamentary Report on this subject,—"Freedom of Labour," including the effects of the combination, settlement, and apprenticeship laws, corporation privileges, &c.,—"The Timber Duties," or how to have wood bad and dear,—"The Coffee and Sugar Duties,"—"The Sunday-school System"—and "Mechanics' Institutions," in which the comparative failure of this class of institutions is lamented, and reasons for it suggested. The cause of Free Trade is further enforced by popular memoirs of the progress of the woollen, silk, linen, and cotton manufactures. To the usual annual lists of patents, there is this year added a descriptive summary of the "Progress of Invention and Discovery," during the last twelve months, which, if it does not contain every thing deserving of special notice, at least notices every thing in a spirit of candour and impartiality; as also a List of Premiums for New Inventions and Improvements. The Census of 1841 has furnished a set of tables of the Population of the United Kingdom, more comprehensive and complete than we expected to meet with at so early a period of the year. Among other new tables we observe one, which in this age of rapid railway travelling, will be found particularly useful; it is a Time Table, supplied by Mr. Dent, the eminent chronometer maker, "exhibiting the difference of time arising from difference of longitude between the Observatory at Greenwich, and two or three principal places in each of the English counties, also North and South Wales, Edinburgh, Dublin, and Paris." Altogether this is a most excellent number of

a most valuable publication, and well calculated to maintain and extend its reputation throughout the workshops of England.

ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

*** *Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for that purpose.*

HOOTON DEVERILL, OF NOTTINGHAM, LACE MANUFACTURER, *for certain improvements in machinery for making and ornamenting lace, commonly called bobbin-net lace.*—Petty Bag Office, November 10, 1841.

These improvements comprise an ingenious arrangement of mechanism for shogging the guide-bars, comb-bars, &c., of lace machinery, by means of the ordinary jacquard apparatus; and the claim is to the adaptation of the jacquard apparatus to lace-making machinery, through the agency of jacks, tappets and levers, for the purpose of shogging the longitudinal bars, in the manufacture of ornamented lace.

JOHN PALEY, JUN., OF PRESTON, LANCASHIRE, MANUFACTURER, *for certain improvements in looms for weaving.*—Petty Bag Office, November 10, 1841.

The following improvements are comprehended in this patent:—

Firstly. A new arrangement of apparatus for giving a more direct vibrating motion to the picking sticks than is obtained by any of the ordinary methods; for this purpose the picking sticks are placed on the upper ends of two vertical shafts, on the lower end of which is a friction roller: two pair of cams on the tappet shafts moving these rollers to and fro, give a reciprocating motion to the vertical shafts, and thereby produce the requisite action of the pickers.

Secondly. A new mode of producing the treading motion. A rotary motion being given to the treading shaft from the driving wheel of the tappet shaft, a roller is fixed upon the former which carries a band; the ends of this band are attached to different sets of heddles, which shift or divide the threads as the treading shaft revolves.

Thirdly. A mode of regulating or adjusting the weight of the taking-up motion, as the cloth roller increases in diameter; by means of levers, which are kept pressed upon the surface of the cloth by springs, and slide the weight that regulates the taking-up lever along the end of the same.

EDMUND TAYLER, OF KING WILLIAM-STREET, CITY, GENTLEMAN, *for certain improvements in the construction of carriages used on railroads.*—Petty Bag Office, November 11, 1841.

The first of these improvements consists in the employment of papier maché for the construction of the roofs and panels of railway carriages.

The second improvement is a compound axle for such carriages; consisting of a turned wrought-iron axle, upon one end of which a wheel is driven tight up to the shoulder, and keyed there; the other wheel is tightly driven on one end of a wrought-iron tube, and held in its place by upsetting the end of the tube. The axle is then passed through the tube until the end of the tube and the shoulder of the axle are in contact, when it is secured by an iron collar and pins.

The third improvement relates to a mode of constructing wheels for railway carriages by forming the nave and axle all in one piece. In the swell, which forms the nave, six holes are bored, into which the turned ends of six spokes fit; the other ends of the spokes are screwed, and have an oblong slot cut through them. Upon these screwed ends a nut and washer are placed, and over them an iron ring in three segments, the ends of the spokes projecting through it. Around the iron ring, six segments of wood, or of papier maché, are placed, and around them the iron tire in a cold state. The nuts being screwed outwards, press the iron ring and the wooden or other segments tight against the tire, making the wheel firm; to prevent the nuts from becoming unscrewed, keys are passed through them, and through the oblong holes in the spokes.

Another railway wheel, with seven spokes, is formed by seven bars of wrought iron, which are bent into the form of a sector, the sides curving outwards towards the adjacent spoke; upon the inner end of these spokes the nave is cast, and around the continuous rim or periphery, formed by the outer portions of the sectors, six segments of wood or of papier maché are placed, and fastened with iron dowels, and around these a band of thin iron is placed, and the tire is shrunk on in the usual manner. Or, the wooden segments may be compressed and dried, and the tire applied cold, after which the wood may be swelled by means of water, so as to hold the tire firmly in its place.

JAMES GREGORY, COAL MASTER, AND WILLIAM GREEN, TINNER, BOTH OF WEST BROMWICH, *for certain improvements in the manufacture of iron and steel*—Enrolment Office, November 14, 1841.

The crude iron, either in the form of pigs, or in broken pieces, is immersed in water till no further action takes place, which time will vary from two to three weeks, the com-

pletion of the operation being indicated by an oily looking scum forming on the surface of the water. The effect of this operation on the iron is to make it softer and tougher.

If it is desired to give the iron a closer and more brittle texture, after having undergone the preceding, it is submitted to the following operation. The iron being heated to redness in any suitable furnace, it is submitted, in its hot state, to the action of cold water, either by sprinkling, by pouring water over it, or by immersion therein. If an impure iron has been operated upon, it is, after the two foregoing operations, melted in an air cupola, or finery, in the usual manner.

Another operation for refining, which may be employed alone, or in conjunction with the former, consists in melting the iron in a reverberatory furnace, and pouring it, in a fluid state, through a vessel formed like a founder's ladle, or other convenient form, the bottom of which is perforated with holes ¼-inch in diameter, and lined with clay; the fluid metal is received in a vessel of cold water, a deep one being preferred in order that the iron may be cooled before reaching the bottom. This process gives a close texture, and white colour to the iron, which is said to be much better adapted for making either cast or malleable iron than that which has been only prepared in the ordinary way.

The improvement in the manufacture of steel consists in making it from iron which has been subjected to the foregoing operations.

The claim is, 1. To improving the quality of cast or pig iron, by subjecting it to the action of water, whether such water is hot or cold, or the iron at the time of the application of such water is hot or cold.

2. To improving the quality of iron by pouring it into water while in a melted state, in the manner described.

JOHN M'BRIDE, MANAGER OF THE NURSERY SPINNING-MILLS, HUTCHINSONTOWN, GLASGOW, *for certain improvements in the machinery and apparatus for dressing and weaving cotton, silk, flax, wool, and other fibrous substances.*—Rolls Chapel Office, November 20, 1841.

These improvements consist, firstly, in a new mode of applying the jacquard, in the power loom, to the working of leaves of heddles for the purpose of weaving figured, or flowered, cloth; and in a new arrangement of the mechanism for raising the leaves of heddles in connexion with the jacquard.

Secondly, in working by the power loom, a jacquard harness, or a jacquard with leaves, in combination with another movement of leaves of heddles upon the same web, for the purpose of weaving large patterns of damasked, or other figured cloth. The jacquard harness is placed on the back part of the warp, or web, and is made to work the flower, or ornamental part of the cloth, while a separate movement of heddles in the front is made to twill the ground and flower, or ornamental part of the cloth. The employment of a separate movement of heddles to twill the ground and flower, makes it necessary to move the jacquard harness only once during a number of shots or picks of the loom, and thereby diminishes the wear and tear of the jacquard, and simplifies the working of the harness, rendering it a matter of no difficulty; whereas, hitherto, the jacquard being employed by power to work the harness for the whole web, has required to be moved every beat of the lay.

Thirdly, in a novel arrangement of mechanism for the purpose of stopping the loom when the weft-shoot breaks, or is wanting, and also for stopping the further movement of the heddles or harness, and the movement of the cloth-beam, all being accomplished simultaneously. A chief feature in this apparatus is to effect the simultaneous stoppage of the heddle or harness that may be employed for figuring and weaving the cloth. It will be obvious to the practical weaver, that were the heddle or harness to move a few threads after the weft had ceased to pass into the cloth, a part of the pattern would be gone over, and when the weft was again resumed, that part of the pattern wrought by the heddles or harness, in the absence of the weft, would be left out, and consequently the figure would be imperfect. The mechanism for carrying out these several improvements is clearly described and shown in the numerous drawings accompanying the specification, without which it would be impossible to give any perfect idea of the machinery.

WILLIAM GALL, OF BERESFORD-TERRACE, SURREY, *for certain improvements in the construction of inkstands.* Enrolment Office, November 22, 1841.

The object of these improvements is to present the ink for use uniformly at the same height, and in a conveniently formed dipping place; to present but a small surface of ink to evaporation; and to use the upper stratum of ink clear from all sediment and precipitated matter.

For this purpose, the inkstand or holder is composed of glass, having a small funnel-shaped dipping place at top, and closed at bottom by an India-rubber or other elastic diaphragm. The glass part of the inkstand is supported and turns freely within a hollow case of metal. To the India-rubber a metal plate or table is cemented, to the under side of which is affixed a vertical screw; this screw turns in a corresponding female screw, carried by a bar, which crosses from side to side of the metal

casing. On turning the glass part of the inkstand in one direction, therefore, the screw descends through this bar, and drawing down the flexible diaphragm, increases the capacity of the ink-holder; on turning it in the opposite direction, the screw rises, and, thrusting the diaphragm inwards, diminishes the capacity of the ink-holder, and the ink is consequently forced up into the dipping-place, from which it can at any time be withdrawn by a few turns of the ink-glass.

CHRISTOPHER DUMONT, OF MARK-LANE, TOWER-STREET, *for improvements in the manufacture of metallic letters, figures, and other devices.* (A communication.) Enrolment Office, November 22, 1841.

These improvements refer to the manufacture of concave letters, figures, and other devices, for inscriptions on houses, shops, and sign-boards, by stamping or pressing them, and at the same time cutting them out, of thin sheets of metal, thereby obviating the necessity for trimming or dressing, which is required when otherwise formed of such materials. For this purpose, a mould or model is first formed in wax or other plastic material of the letter or figure required, taking care to surround it with a deep angular or V shaped groove; from this model a plaster cast is taken, from which an impression is obtained in fine cast-iron, and finished in the way usually pursued by die-sinkers. This forms the die, to which a corresponding force is formed in zinc, or other hard metal. On placing a sheet of thin metal between the die and the force, and subjecting the whole to powerful pressure, the sheet metal becomes forced into the convexity of the die, at the same time that it is cut out in the form of the letter, &c., by the angular or cutting edges of the outline.

## LIST OF DESIGNS REGISTERED BETWEEN OCTOBER 28TH AND NOVEMBER 24TH, 1841.

| Date of Registration. 1841. | | Number on the Register. | Registered Proprietors' Names. | Subject of Design. | Time for which protection is granted. |
|---|---|---|---|---|---|
| Oct. | 28 | 894 | S. Ackroyd | Fender | 3 |
| | " | 895 | The Colebrookdale Company | Ditto | 3 |
| | 29 | 896 | J. F. & G. Clarke | Carpet | 1 |
| Nov. | 1 | 897 | T. S. Dismore and Son | Bracelet | 3 |
| | " | 898 | H. Woodward and Co. | Carpet | 1 |
| | " | 899 | G. R. Elkington | Inkstand | 3 |
| | 2 | 900 | S. Ackroyd | Stove | 3 |
| | " | 901 | B. Walton and Co. | Kettle | 3 |
| | " | 902,3 | Jeffrey, Wise, and Horne | Stained Paper | 1 |
| | " | 904 | Southwell and Co. | Carpet | 1 |
| | 3 | 905 | The Colebrookdale Company | Stove | 3 |
| | " | 906 | Job Hart Buck | Penholder | 1 |
| | 4 | 907 | H. Longden and Son | Stove | 3 |
| | 8 | 908 | Merry, Phipson, and Parker | Light extinguisher | 3 |
| | " | 909 | H. Brinton | Carpet | 1 |
| | " | 910 | G. and H. Talbot and Sons | Ditto | 1 |
| | 9 | 911 | J. Reading | Hook and eye | 3 |
| | " | 912 | Dobson and Son | Carpet | 1 |
| | " | 913 | G. Riddle | Pencil case | 3 |
| | 10 | 914,5 | Smith and Kemp | Brace buttons | 3 |
| | 11 | 916,7 | R. Stratton | Wagons | 1 |
| | " | 918,20 | Thomas Rainforth Tebbutt | Oxygenating chimneys for lamps | 1 |
| | 12 | 921 | S. Ackroyd | Fender | 3 |
| | " | 922 | George Benton | Aperitive fountain | 3 |
| | 17 | 923 | Robert Sorby and Son | Reaping hook | 3 |
| | " | 924 | Alex. Southwood Stocker | Waistcoat band fastening | 3 |
| | 19 | 925,6 | Kitely and Fawcett | Carpets | 1 |
| | " | 927 | William Pendrell | Penholder | 1 |
| | " | 928 | Robert Sorby and Son | Reaping hook | 3 |
| | 22 | 929 | James Badcock | Self-acting oiling apparatus | 3 |
| | 23 | 930 | James Marlow | Harness furniture | 3 |
| | 24 | 931 | James Barlow | Candle lamp shade | 3 |
| | " | 932,3 | G. and H. Talbot and Sons | Carpets | 1 |
| | " | 934 | John Higgins | Copper-plate printing-press | 3 |
| | " | 935 | Simon King | Stove | 3 |

## LIST OF ENGLISH PATENTS GRANTED BETWEEN THE 24TH OF OCTOBER AND THE 25TH OF NOVEMBER, 1841.

William Golden, of Huddersfield, gun-maker, and John Hanson, of the same place, lead-pipe manufacturer, for certain improvements in fire-arms, and in the bullets or other projectiles to be used therewith. Nov. 2; six months.

Thomas Macauley, of Curtain-road, upholsterer, for certain improvements in bedsteads, which are convertible into other useful forms or articles of furniture. Nov. 2; six months.

Robert Logan, of Blackheath, esquire, for improvements in obtaining and preparing the fibres and other products of the cocoa nut and its husk. Nov. 2; six months.

Robert Holt, of Manchester, cotton-spinner, and Robinson Jackson, of Manchester, aforesaid, engineer, for certain improvements in machinery, or apparatus for the production of rotary motion, for obtaining mechanical power, which said improve-

ments are also applicable for raising and impelling fluids. Nov. 2; six months.

Moses Poole, of Lincoln's-inn, gentleman, for improvements in machinery, used in the manufacture of bobbin-net or twist lace. (Being a communication.) Nov. 2; six months.

Henry Kirk, of Tavistock-square, gentleman, for a substitute for ice for skating and sliding purposes. Nov. 2; six months.

William Brunton, of Neath, Glamorganshire, engineer, for an improved method or means of dressing ores and separating metals or minerals from other substances. Nov. 2; six months.

Jeremiah Bynner, of Birmingham, lamp-maker, for improvements in gas burners. Nov. 2; six months.

Edward Robert Simmons, of Croydon, esquire, for improvements in apparatus for preventing splashing in walking. Nov. 2; six months.

Henry King, of Webber-row, Westminster-road, engineer, for certain improvements in steam-engines and boilers. Nov. 4; six months.

Jules Lejune, of North-place, Cumberland-market, manufacturing chemist, for a means of condensing and collecting the sulphurous and metallic vapours which are evolved in the treatment by heat of all kinds of ores. Nov. 4; six months.

Job Cutler, of Ladypool-lane, Birmingham, gentleman, for improvements in the construction of the tubular flues of steam-boilers. Nov. 6; six months.

John Carr, of North Shields, earthenware manufacturer, and Aaron Ryles, of the same place, agent, for an improved mode of operating in certain processes for ornamenting glass. Nov. 9; six months.

Jesse Ross, of Leicester, manufacturer, for a new wool-combing apparatus. Nov. 9; six months.

Henry Davies, of Birmingham, engineer, for certain improved machinery suitable for applying power to communicate locomotion to bodies requiring to be moved on land or water. Nov. 9; six months.

Jesse Smith, of Wolverhampton, lock-maker, for improvements in the construction of locks and latches, applicable for doors and other purposes. Nov. 9; six months.

William Edward Newton, of Chancery-lane, civil engineer, for certain improvements in the production of ammonia. (Being a communication.) Nov. 9; six months.

William Palmer, of Sutton-street, Clerkenwell, manufacturer, for improvements in the manufacture of candles. (Being partly a communication.) Nov. 9; six months.

John Garnett, of Liverpool, merchant, and Joseph Williams, of Liverpool, aforesaid, manufacturing chemist, for an improved method of manufacturing salt from brine. Nov. 9; six months.

John Burnell, (the younger) of Whitechapel, manufacturer, for improvements in the manufacture of leaves or sheets of horn, commonly called lantern leaves, and in the construction of horn lanterns. Nov. 9; six months.

John Edwards, of Cow Cross-street, gentleman, [illegible] improved strap or band, for driving machi[illegible] and for other purposes. Nov. 9; six months.

James Stewart, of Osnaburgh-street, St. Pancras, pianoforte maker, for certain improvements in the action of horizontal pianofortes. Nov. 11; six months.

George Allarton, of West Bromwich, Stafford, surgeon, for certain improvements in the method of balling and blooming iron. Nov. 11; six months.

John Peter Booth, of Hatton-garden, feather-merchant, for certain improvements in the manufacture of a substance, or compound fabric, which will be applicable to the making of quilts, coverlets, and wadding, for purposes of clothing or furniture. Nov. 11; six months.

Isaac Davis, of New Bond-street, optician, for improvements in the manufacture of sealing-wax, which compounds are applicable to other useful purposes. Nov. 11; six months.

Edward Joseph Francois Duclos de Boussons, of Clyne Wood Metallurgical-works, Swansea, for improvements in the manufacture of copper. Nov. 11; six months.

John Onions, of Field-lane, Barlaston, Stafford, engineer, for improvements in the manufacture of certain descriptions of nails, screws, and chains. Nov. 11; six months.

James Young, of Newton-le-Willows, chemist, for certain improvements in the manufacture of ammonia. and the salts of ammonia, and in apparatus for combining ammonia, carbonic acid, and other gases with liquids. Nov. 11; six months.

Isaac Dodds, of Sheffield, engineer, for certain improvements in the modes or methods of supplying gas for the purposes of illuminating towns and other places. Nov. 13; six months.

Henry Mortimer, of Frith-street, Soho, gentleman, for improvements in covering ways and surfaces, and in constructing arches. Nov. 16; six months.

John Squire, of Albany-place, Regent's-park, engineer, for certain improvements in the construction of steam-boilers or generators. Nov. 16; six months.

Robert Sterling Newall, of Gateshead, Durham, wire-rope manufacturer, for improvements in the manufacture of flat bands. Nov. 16; six months.

John Venables, of Burslem, in the county of Stafford, earthenware manufacturer, and John Tunnicliff, of the same place, bricklayer, for a new and improved method of building and constructing ovens used by potters and china-manufacturers in the firing of their wares. Nov. 20; two months.

William Manwaring, of York-street, Lambeth, engineer, for certain improvements in the manufacture of sugar. Nov. 23; six months.

Richard Gurney, of Trewinnion-house, Cornwall, for a method of cutting wood and incrusting the same in order to present a sure footing for horses, and other purposes. Nov. 25; six months.

## NOTES AND NOTICES.

*The Thames Tunnel* may now be said to be completed, the passage under the river having been carried through from side to side, that is to say, from the vertical shaft on the Rotherhithe side to the corresponding shaft on the Wapping shore. All that now remains to be done is, to form the approaches on both sides; and after that, (the most difficult task of all, we suspect,) to prevail upon people to use it. A cheap steam ferry overhead would not leave the tunnel a single passenger, except from curiosity. A prodigious work truly it is; but, at the same time, one of the most absurd and useless of the present age.

*An Actual Working Air Engine.*—The newspapers, metropolitan as well as provincial, have been teeming lately with accounts of the wonderful performance of an air engine, the joint invention of the Rev. Dr. Stirling, of Galston, and Mr. Stirling, engineer, of Dundee. "The machine," it is stated, "has been working *occasionally* for above six months:" an equivocal sort of statement, which may mean either that it has been working during the greater part of the six months, (the insinuated meaning, no doubt,) or that it has only been worked during as many days. But we are farther told, that "it has now, for upwards of a month, been driving all the machinery at the extensive engineering works of the Dundee Foundry, which a steam-engine of approved construction had hitherto been employed to do." This it may have done, and yet *not have been working all the while, nor half the while.* The inventors or patentees, or patentee proprietors—whoever the authors of these statements may be—should be a little more frank and explicit, if they care any thing for the good opinion of the scientific public. From all we yet know of this engine and its performances, we see no reason to anticipate for it any greater success than has attended the many previous attempts of the same sort—all of which have, after early days of equal puffing and promise, turned out in the end to be decided failures.

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# Mechanics' Magazine,

## MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 956.] SATURDAY, DECEMBER 4, 1841. [Price 6*d.*

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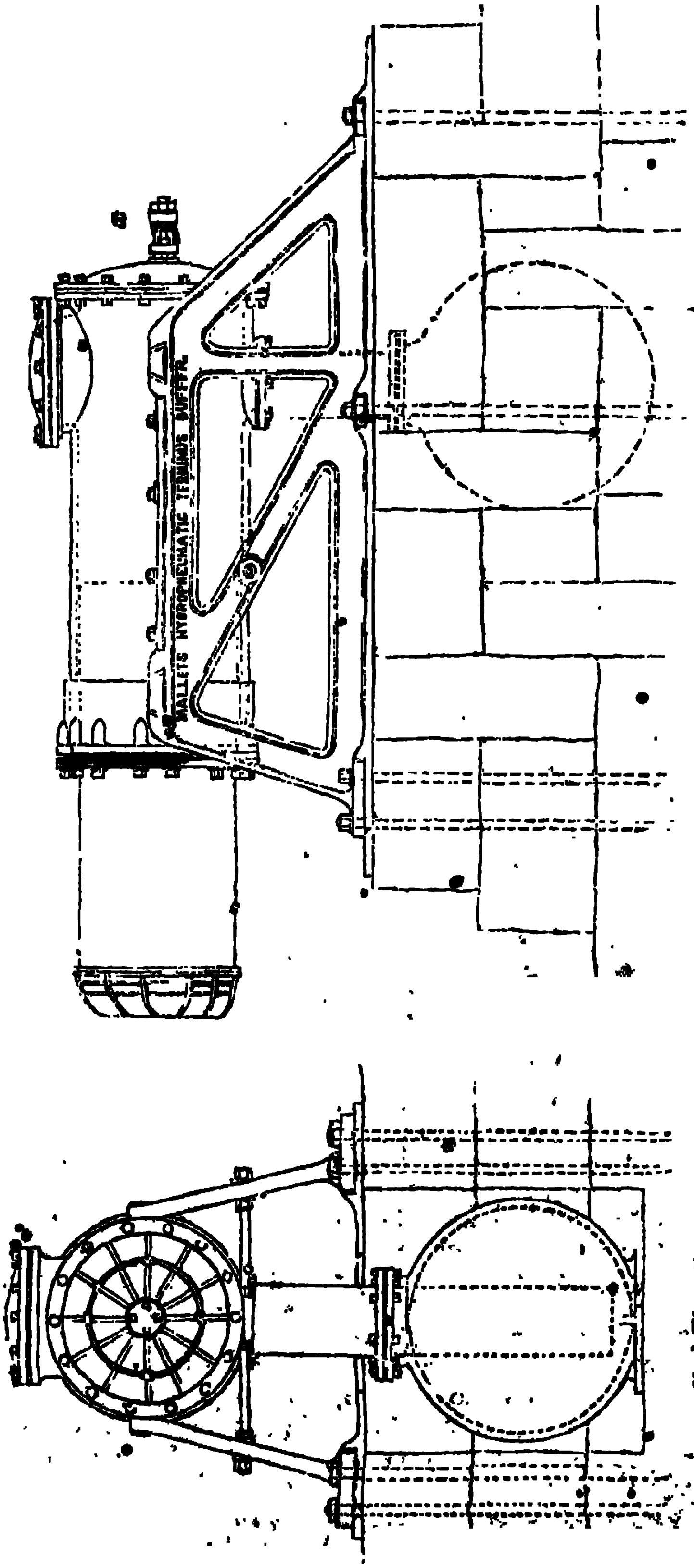
MALLET'S HYDRO-PNEUMATIC BUFFERS.

Fig. 3.



Side Elevation.

End Elevation.

DESCRIPTION OF MALLET'S HYDRO-PNEUMATIC BUFFERS. BY THE INVENTOR.

The use of elastic fluids, in the form of springs, has been long since proposed, and occasionally brought into practice, but never upon a large scale, or with very successful results. This has arisen principally from the fact, that it is impossible to make any cylinder and piston, or any rod and stuffing-box, absolutely and permanently air-tight, especially under the effects of sudden and violent compressions: hence, the air, or other elastic fluid used, has always been found gradually to escape from the vessel provided for its compression, leaving the whole apparatus springless.

Yet, if this difficulty be once overcome, the advantages accruing from the use of air, (as the most available elastic fluid we have,) as a spring, are very great.

The spring is itself practically without weight. It is capable, without any "tempering," and, again, without any practical increase of weight, of having its elastic range and its resisting power increased to any amount; or, on the other hand, modified with the minutest nicety. Unlike the solid spring of steel or other solid, it is incapable of being overstrained, or of being broken by any force.

It remains a spring at all temperatures, and in all climates; and, lastly, its properties are such, that the resisting energy of the spring increases with the amount of the force with which it is compressed or urged, and, by a suitable arrangement, may be made to increase according to any assignable law.

At the present time there are few, if any, applications of elastic materials so important as those to the buffing apparatus of railway carriages, of all classes: upon their perfection the comfort, and, in cases of collision, &c., the safety of railway passengers much depends.

Some months ago, a proposal was published in the *Mechanics' Magazine*, for the use of air, as a buffer spring, confined in bags of caoutchouc cloth within cylinders, and compressed by a plug or piston.

At a very much earlier period, however, the subject of air buffers had engaged my attention, and with methods, as I conceive, of a much more sound and effective kind for making the invention practically available.

In a word, my method of overcoming the one great obstacle to the use of air as a spring consists in confining the air to be compressed by a body of water, or other liquid; and is based on the well-known fact, that joints or sliding surfaces can readily be made *water-tight*, and kept so, which cannot be made or maintained *air-tight*.

In the month of February, 1836, I designed a set of buffing apparatus upon this basis, which was constructed by the firm with which I am connected, and placed on the Dublin and Kingstown Railway, attached to one of the open passenger carriages. Fig. 1 [a] of the drawings sent herewith shows a plan of the under carriage, fitted with the buffing apparatus; and fig. 1 [b], a side view of the air cylinder, &c., on a larger scale: they are traced from the original dated plans. The system of *thorough* buffing, as invented by Mr. Bergin, the intelligent manager of the railway, is in use upon the Dublin and Kingstown line; and hence was adopted in the hydro-pneumatic buffer, as then designed. *a a* is a truly bored cylinder of cast-iron, closed at each end by a cover, provided with a large gland or stuffing-box, through which the buffer-rod passes, being turned truly like a piston-rod, which in fact it is. The buffer-rod going from end to end of the carriage, passes right through the cylinder, and carries a solid piston, packed with leather collars and pressed leather cups, which when in a state of repose is situated in the middle of the length of the cylinder. The piston is shown still more enlarged in fig. 2.

*b b* are two air-vessels of a cylindrical form, with hemispherical ends cast on to the cylinder, and standing vertical upon its upper side when *in situ*. The capacity of each air-vessel is equal to that of half the cylinder, minus the bulk of the piston and included portion of buffer-rod. The diameter of the cylinder was 6 inches, and that of the buffer-rod $2\frac{1}{8}$ inches, of solid iron. By means of a suitably situated screw-plug, the whole of the cylinder was filled quite full of water, leaving the two air-vessels above it full of air, which, by a condensing syringe, was brought to a density of one additional atmosphere, or to about 15 lbs. per square inch, plus pressure.

In this state of things, it is obvious that,

any force acting at one end of the buffer-rod would compress the air in one air-vessel and rarefy that in the other, by carrying the central piston towards one end of the cylinder, and thus driving the water at that end up into the air-vessel. It is also plain that, as the water will always remain at the lowest part of the

Fig. 1,[a]

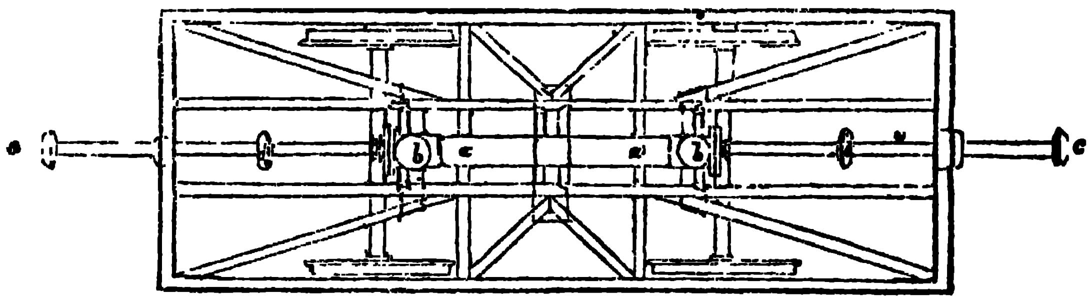



Fig. 1,[b]

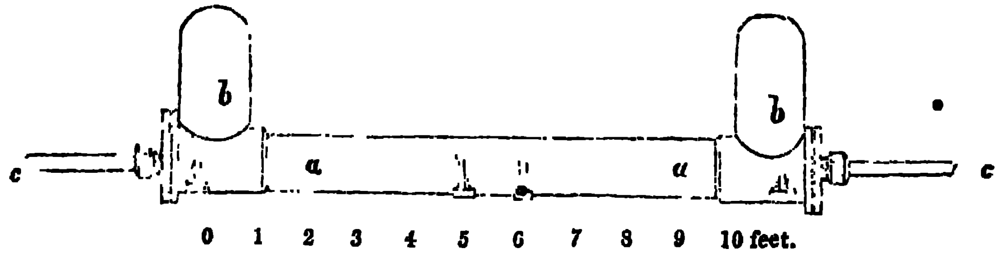
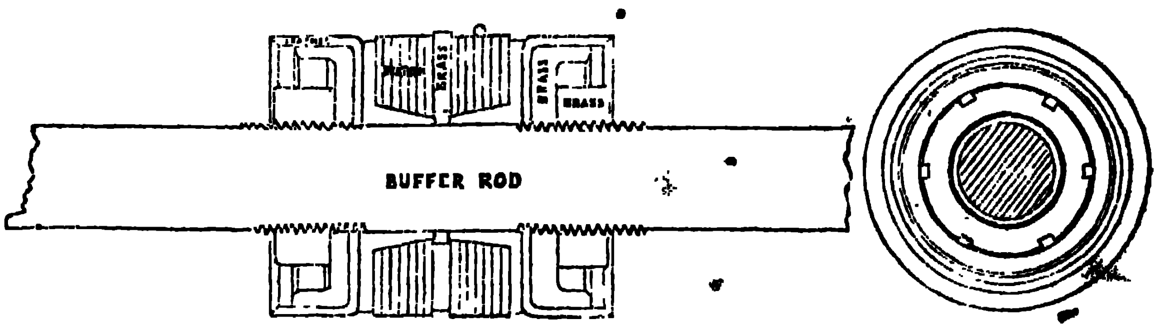



Fig. 2




vessel, it will be constantly interposed between the air and the only possible places of escape from the cylinder, namely, the end covers and stuffing-boxes.

The range of the buffer-rod was limited to two feet—a limit, however, which it was scarcely possible it could ever reach by any force, as the air would then be condensed into about one-fiftieth of its original volume; but, as a further precaution, the buffer-heads *c c*, and the counter buffer-heads *d d*, were so arranged, that, at the extremity of the range, any shock given to the buffer-rod would be visited upon and distributed through every part of the frame of the carriage. The whole buffing apparatus was secured by bolting to the frame of the under carriage, to which it became a

firm and substantial spine or backbone, as it were, increasing its strength, in place of breaking it.

The very first experiment made with this buffer, on the Dublin and Kingstown railway, consisted in bringing the carriage upon one of the lines, and causing ten or twelve of the railway porters to run it, as fast as they could; full tilt against one of the stone walls of the station-house, from which it rebounded, uninjured, like a piece of Indian rubber. The piston was not nearly driven home, or to its whole range, but had passed through more than four-fifths of it, indicating a blow equal to more than 1,500 lbs.

The carriage was then connected with a locomotive engine, and drawn along the line, going at various speeds, stopping and reversing as suddenly as possible. The results were in every respect satisfactory.

This buffer continued a long time in use upon the Dublin and Kingstown railways—as long, I believe, as the under carriage lasted—and at length fell into disuse from neglect, as standing isolated, in the midst of a different buffing system.

I have stated that the range of this buffer was 24 inches: the effective area of compression was = 28·3 − 3·5 = 24·8 square inches, say 25 square inches. Now, in accordance with Marriott's law, if an elastic fluid be compressed into the $n$th part of its volume, its elasticity will be increased $n$ times, the temperature being assumed to remain constant.

If, therefore, we assume the total range of 24 inches to be divided into five intervals, the elastic resistances afforded by the buffers will be, respectively;

| | | |
|---|---|---|
| At 6 in. range | = | 187·5 lbs. |
| 12 in. ,, | = | 375 |
| 18 in. ,, | = | 750 |
| 21 in. ,, | = | 1500 |
| 24 in. ,, | = | infinite. |

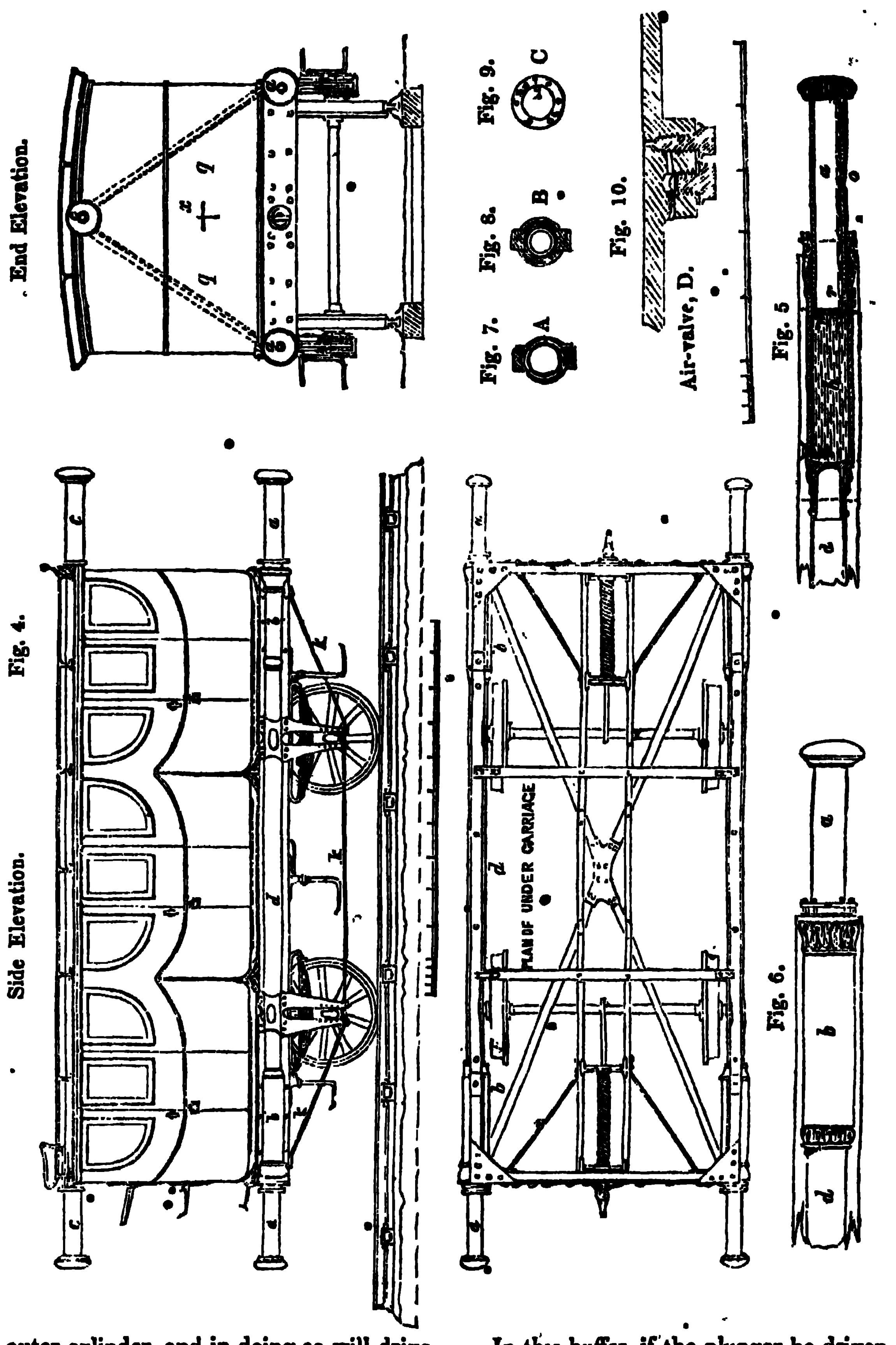
But, further, as the air in compression is heated, its elasticity will be slightly increased, and as, in proportion that the air in one air-vessel is compressed, that in the other is rarefied, so a still further augmentation of resistance follows.

The subject passed from my mind, and was forgotten, until the early part of last year, when it was recalled by the frequency of railway accidents, and I then designed two improved forms of air buffer, of which I send tracings, and both of which, I am of opinion, may be made of practical value. The design No. 3 is for a great terminus buffer, to be placed in a station-house, or other similar situation, where trains require to be brought up, without the possibility of running beyond a given point.

Such buffers are at present occasionally in use, of various constructions. On the Blackwall railway, trusses of hay are placed at the extremity of the station-house, to receive the shock of an incoming carriage; on the Dublin and Kingstown line, terminus buffers, with powerful compound spiral springs, are in use; and so forth. But it is very doubtful how far any one of these methods now in use would be competent to resist the shock of an incoming train at a high velocity; or, if so, whether it would not bring it up so suddenly, as to effect much of the damage of actual collision.

These conditions, however, I conceive my hydro-pneumatic terminus buffer may be made fully to answer. Fig. 3 (on our front page) is a side and end elevation of such a buffer. The construction is so plain, as scarcely to need description. A large cast-iron cylinder, having a gland at one end and close at the other, is firmly secured down in a horizontal position to a mass of masonry, by lateral framing of cast-iron on a bed plate. The gland of this is filled by a turned cylinder of cast-iron, also hollow, bore of 36 inches diameter, open at its inner, and closed at its outer end, which is armed with a large padded leather buffer-head. This cylinder is free to slide in the gland horizontally. The outer cylinder has got at its lower side a large aperture, communicating with a spherical air-vessel by a pipe dipping into it: this is enclosed in a cavity of the masonry.

The cylinder is filled with water, simply by pouring it in at the top man lid, which is then screwed down, and the buffer is ready for use. The air in the air-vessel, which is here of about equal capacity with the cylinder, is of course permanently compressed with a force equal to a column of water of the altitude from the surface of the water in the air-vessel to the highest part of the cylinder; and if any impulse be given to the inner cylinder, which may be considered simply as a large plunger or ram, it will be driven forwards into the




outer cylinder, and in doing so will drive an equal bulk of water into the air-vessel, compressing the air therein, the elastic resistance of which will increase in proportion to the compressing force.

In this buffer, if the plunger be driven in half-way, the air in the air-vessel will have a density of one atmosphere, and the total resistance afforded at this point would be = 15,270 lbs., and so on; and

if the plunger were driven in so far, that 10 atmospheres was the density of the air, the buffer-head would equilibrate a blow having a force of about sixty-eight tons. The total range given here to this buffer is 3½ feet; but it is obvious that any length of range desirable may be given to such an instrument, so as to bring up a railway train with any required degree of gentleness. From the properties of elastic bodies, the plunger, when struck by an imperfectly elastic system, such as a railway train, and driven in by it, would again rebound with considerable force, and would be liable to be driven wholly out of the gland: this is provided for by a turned rod, marked $x$, secured in the axis of the plunger, and passing through a small stuffing-box in the back end of the outer cylinder, and having a large nut and a number of leather collars to deaden the blow upon its extremity: this catches the plunger on the return stroke.

Such is the method I propose for bringing up a train at a station. I now proceed to describe the application of my system of buffing to railway carriages, in connection with a new method of framing these; so that the only effective protection possible shall be given to railway passengers in the event of collision, namely, that they shall sit in carriages which not only will ease the blow to the utmost, but shall be competent, by their construction, to bear the residual shock without being crushed to fragments, or being thrown off the line in some direction transverse to their original motion. Until these objects be effected, railway travelling must be always liable to frightful accidents; for it must be obvious to any one who has practically observed the working of any long line of railway, that, however perfect the way and management may be—however complete the system of signals, telegraphs, &c., collisions will occur, as they do occur on common roads, to the end of the chapter.

The method by which I propose to meet this most desirable end consists in adapting to passenger carriages hydro-pneumatic buffers of a peculiar construction, the efforts of which, in the event of collision, shall be directed through parts of the carriage frame, capable of sustaining the most severe residual shock likely to be visited on them; and in placing buffers at points symmetrically *above and below* the common centre of gravity of the train and load of passengers, &c., or rather, symmetrically round a line formed by joining the centres of gravity of the several carriages and loads, when in motion on the rails; whereas, at present, all the buffers in use, whether in themselves good or bad, are placed *below* the centre of gravity of the whole train. Thus, in the event of collision, a motion of revolution *must* ensue in every carriage: in other words, the carriages are either upset or thrown off the rails.

The design fig. 4 represents an improved passenger close carriage, thus arranged, in side and end elevation, and plan of under carriage, together with the details of the hydro-pneumatic buffer. The same letters refer to all the figures. *a a a a* are the lower buffers, placed in the usual position at the four corners of the under carriage; *c c* are similar, but smaller buffers, placed in the centre of the breadth of the carriage, in the thickness of the roof, so that on the end elevation it will be perceived the three buffers at either end are placed in the angles of an isosceles triangle, and that a horizontal line passing through the common centre of gravity of the carriage and its load, in the direction of motion, would pass through the point $x$, or nearly through the centre of the triangle, generally a little below it. It is thus obvious that, in the event of any collision with another similar carriage, or with any vertical plane opposed to its motion, the *whole* motion of the mass will be destroyed or absorbed, and there will be no resultant to produce revolution round a point in the system; in other words, the carriage and passengers may receive a blow of any degree of violence, but there will be no tendency in the carriage to capsize, or leap off the rails, or be thrown over the next one to it, as is now the usual result.

But we have further to provide against the *violence* of the blow in such a way that it shall be eased as much as possible on the passengers and carriages, and that the latter shall be competent to sustain the residual shock without going to pieces. A careful inspection of the plan will render minute description unnecessary, as to the general structure of the body and of the under carriage. We will first describe the construction of the buffers, figs. 5 and 6: *b* is a hollow cylinder of cast-iron, close at one end and

carrying a gland or stuffing-box at the other; it may, if decreased weight be important, be made of wrought-iron, or cast in gun-metal, about ¼-inch thick, and ornamented in any way exteriorly. The close end of this cylinder is prepared to receive and connect firmly with a tube of wrought-iron, made of ½-inch boiler plate welded, which forms the central part of each side of the under carriage frame, and connects the corner buffers at the same side together, forming a rigid column between them. At the upper and under sides of this tube and the buffer cylinders, the ash timber top and bottom frames of the under carriage are secured by bolts, as shown in the figures. Within the gland is placed, free to slide in or out, the turned plunger or buffer-ram $a$, which is hollow, of gun-metal or cast-iron, close at both ends, and having no opening into it, except the one in its lower side, when *in situ* at E. The outer end of each plunger is armed with the usual stuffed leather buffer-head. The plunger being in its place, and out to its extreme range, and the gland packed, the cylinder $b$ is filled quite full of water by the aperture at $p$, and the screw plug again fastened therein. The buffer is now ready for use; for it is obvious that any force which urges the plunger inwards will drive the water from the cylinder $b$, through the aperture $r$, into the interior of the plunger $a$, and that, on being relieved, the air will again expand, and return the water back into the cylinder $b$.

But, to make this arrangement perfect, two precautions require still to be taken. The plunger must be prevented from slipping altogether out of the cylinder, or getting beyond the gland by the rebound, and such a degree of *springiness* must be given to the buffer, at all times, as shall just overcome the friction of the gland, and make it feel easy, or "corky," as it is commonly called. To prevent the return of the plunger beyond the proper point, and enable air to be condensed into it to any requisite degree, a projecting fillet, $t\ t$, is cast upon its inner end, the circumference of which being divided into six equal parts, three of these are cut away. The projecting fillets $v\ w$, in the interior of the cylinder $b$, forming the packing spaces and plunger guide of the gland, are likewise so divided and the alternate portions cut away, as better shown in the transverse section, fig. 8 at B. It is hence obvious, that the plunger can be passed into the cylinder, the three projections $t\ t$ going into the spaces cut away of the fillets $v\ w$; and on turning the plunger round its axis one-sixth, it is plain that the projections $t\ t$ will *meet* the remaining portions of the fillets at $v$, and prevent its return.

But the plunger must be maintained in this position, that is, prevented in use from turning round, in order that the aperture $r$ may be always at the lower side in the cylinder $b$; for this purpose the plunger has a slot planed out at its lower side, along its whole length, at $o\ o$; a corresponding projection of leather is formed in the gland $s$, at $y$; the gland is slipped over the plunger before the latter is pushed into the cylinder, and as soon as the gland is secured by its own six bolts, $m\ m$, to the stuffing-box of the cylinder $b$, it is plain the plunger can no longer turn round; it is only free to slide in and out, within its prescribed range. A firm seat is procured for the packing against the fillet $w$, by means of a loose collar or bushing of brass, first put in in two parts.

Air may now be condensed into the interior of the plunger, to any degree desirable, which will generally be found to be to about one atmosphere; at D, a valve is provided of great simplicity, consisting merely of two screw plugs of brass tapped into the cast iron, and shown in fig. 10 at full size; the plug $n$ is placed directly beneath the aperture $r$, into the plunger, so that any air which enters them shall bubble up through the water and ascend into the inside of the plunger. This plug is of soft yellow brass, with a conical extremity fitting a seat bored in the cast iron of the cylinder $b$; there is a leather or leaden collar under its head; a small lateral aperture just above the seat leads into the chamber of the second plug $m$, which has a simple leather washer under its head. To use this valve, the plug $m$ is unscrewed, and a union joint on the extremity of a flexible tube, connected with a condensing syringe or reservoir of condensed air, is screwed into its place; the screw $n$ is now withdrawn by about four revolutions; the air is then free to enter the inside of the plunger as soon as it is condensed sufficiently, as indicated by a gauge attached to the condensing ap-

paratus; the plug *n* is screwed hard home, the union joint removed, and the plug *m* returned to its place. The vessel *b* is now staunch.

As the whole system is by construction air tight, there being in all buffers, upon my principle, no escape for the air but through the water, this operation of charging the cylinders with air need never be repeated more than once, unless the buffer be taken asunder for examination or repair. It is also plain, that this charging with air may be done almost instantaneously from a fixed reservoir, maintained at the required pressure by a pump, wrought by power at the carriage station of a line of railway—the carriages being brought to it, in the same way as locomotive boilers are on some lines filled with *hot* water from a fixed boiler at the engine station.

It may be observed now on inspecting the side elevation and plan of the under carriage, that each side frame of the latter constitutes a cylindrical iron column of immense strength to resist an endway shock, and that the two upper buffers are connected by a similar column. It will be further seen that the other arrangements of the under carriage frame, by the application of diagonal stays and braces, and by the judicious use of angle plating and straps, are such as ensure the most uniform and *consenting* resistance to blows, or other strains, whether endways or laterally. The principle, so well urged by Sir Robert Seppings, with respect to the framing of vessels has been kept in view, as it ever should be, "that in any complex system, partial weakness becomes the weakness of the whole structure."

The axle guards are by a somewhat novel construction made subservient to strengthen the side frames, and afford fulcra for the rod *k k*, which, as a truss, *stiffens* the under carriage in the vertical. But the structure would still be a weak one, as liable to be twisted; to provide against which, and also to prevent passengers being injured by the ends of the carriage being suddenly pierced by an obstacle, the top buffers are connected with the lower corner ones, at either end, by a framing of wrought iron, shown in dotted lines on the end elevation at *q q;* the interior of the triangle thus formed is sheeted in with thin plate iron, about No. 10, wire gauge. Previously to being riveted on to the triangular frame, it is *hammered convex* towards the outside, with a convexity of about 2 inches. The whole of this iron frame, which firmly secures together the three lines of buffers, lies concealed in the thickness of the end sheeting of the carriage. These three points may be considered as so united, that forming, or being imagined to form, the solid angles of a triangular prism, whose axis is horizontal, and passes through the centre of gravity of the whole system, they shall receive without disturbance the shock of the most severe collision; and certainly looking to the nature of the buffers and their arrangement, they must be allowed to be better competent to sustain such collisions than any of the flimsy, yet ponderous systems of carriage framing now in use. Spiral springs are used for the drag chains; they might of course be formed with hydro-pneumatic springs also, as it is likewise obvious that this method of retaining the elastic fluid of an air spring gives the power of readily forming the springs of carriages, *i. e.*, the bearing springs, on the same plan. Blenkinsop, I believe, tried to use bearing springs for a locomotive engine years ago, formed of cylinders from the bottom of the boiler, which floated, as it were, on pistons bearing on the axles, by virtue of the elasticity of the steam in the boiler. The plan did not answer, however, and the reasons are obvious: the frequent changes of elasticity in the steam of the boiler—the expansion and contraction of the cylinders and pistons by heating and cooling—the difficulty of maintaining them staunch, and of handling them when hot—must have prevented any uniformity of action in such an arrangement. But a hydro-pneumatic railway carriage spring may consist of nothing but an inverted cylinder, with a close top, a stuffing-box at its lower end, and a solid plunger working in it. The water will always be in the lower part of the cylinder, and of course make the stuffing-box air tight. This arrangement abolishes axle guards, and oil boxes, &c. *in toto.* The bearings for the axles are secured directly to the lower ends of the spring plungers, and the cylinder forms the

connection with the under carriage by grasping the plunger.

Of the other details of the design for the under carriage, &c., it is not necessary to say anything; they are quite the same as those furnished by the writer's firm to the Manchester, Bolton and Bury Railway Company, and to the Sarskoeceloe Railway at St. Petersburg, and still in use.

A few words may be added, as to the probable objections that may be made to this system. The first will be, that carriages thus constructed will be enormously heavier than those at present in use. It would unreasonably extend this already long paper, to enter here into details of comparative weight: but I am prepared to show that the carriage above described can be constructed, so that its weight shall not only not exceed, but shall not equal that of the carriages now in use on most lines of railway in Great Britain. I am also ready to show that the cost will be less than that of the Grand Junction pattern of carriages, or of most others that are respectably finished.

Much also might be anticipated in way of objection, as to the degree of care requisite to keep carriages of this construction in working order, as compared with those in use—as to how far, in cases of collision, carriages are likely to be fairly struck end on, and in such a way as to receive the shock by their buffers, and much such matter: but I fear to trespass further, and must leave all such questions to their best answers, the opinions of practical men, and the results of trial.

ROBERT MALLET, Ph.D.,
Ass. Ins. C.E.

Dublin, November 6, 1841.

## ABOLITION OF THE CLIMBING BOY SYSTEM.

It has hitherto been a lasting reproach, that the mercenary and sordid motives of a particular class of tradesmen, coupled with and supported by apathy and want of feeling on the part of the public at large, should have so long perpetuated the disgraceful sacrifice of children of tender years to a cruel, ignominious, and dangerous employment—to perform an operation which can be done—not only as well—but even BETTER by mechanical instruments!

The time, however, is now fast approaching, that is to put an end (we trust for ever) to the employment of children in sweeping chimneys: and we have great pleasure in observing, that in order to direct public attention to such provisions as it will be necessary to make, in some cases, to adapt chimneys to the operation of mechanical cleansing, the philanthropic individual, Mr. Stevens, to whose humane and unwearied exertions we are mainly indebted for the approaching emancipation of "these little negroes of our own growth" has printed for gratuitous distribution, a neat little pamphlet under the title of *Plain Hints on the Subject of Chimney Sweeping as connected with the First of July*, 1842.*

In this pamphlet it is clearly shown to be the interest, as well as the imperative duty, of every one to see whether his chimneys require adapting to the use of the machine, *before the Act comes into operation;* as also the necessity of consulting *an honest and intelligent tradesman* on the subject.

It is stated that some persons on consulting their old chimney-sweepers (who have hitherto thrown every impediment in the way of the immediate introduction of the machine,) have been induced to alter chimneys that really required no alteration: and others have been altered at a considerable expense, where a trifling outlay would have sufficed.

It is well observed, that the legislature did not imagine that chimneys would sweep themselves, nor was any provision made for those whose indolence is too great to admit of the slightest forethought. Parliament resolved to prohibit "live chimney sweeping," when it was seen that every chimney in existence could be safely swept by Glass's machine† with a little contrivance, and with a slight outlay of money; and those who neglect these simple precautions will make their fruitless complaints with a very ill grace.

Mr. Stevens notices in detail the chimneys that do not, as well as those

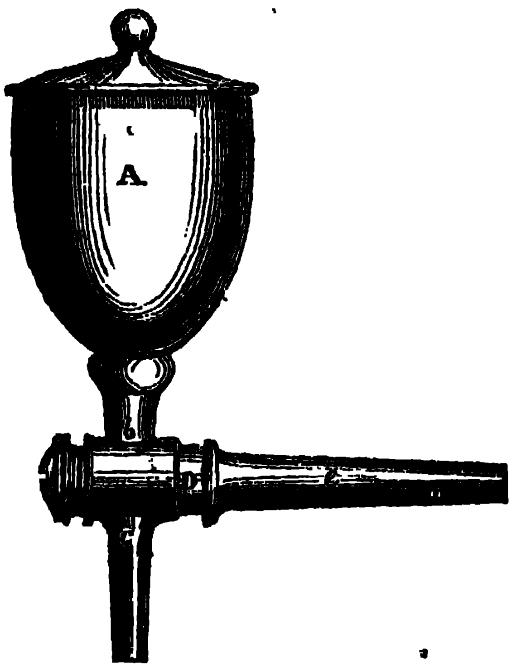
* To be had gratis on application at the Hand-in-Hand Insurance Office, No. 1, Bridge-street, Blackfriars.

† Described in volume ix, page 184.

that will, require to be altered to effect their perfect cleansing by mechanical means; furnishing descriptions, with illustrative engravings, of numerous chimneys in public and private buildings which presented more than ordinary difficulty in their adaptation, and pointing out the easy manner in which each of these difficulties have been effectually surmounted. We would willingly quote largely from this source, but that the pamphlet itself is to be had on such easy terms—only to ask for and have. Every one who takes the least interest in the subject will, of course, possess himself of a copy.

## BADCOCK'S AUTOMATON LUBRICATOR.

(Registered pursuant to Act of Parliament,)




The apparatus shown in the prefixed engraving has been devised for effectually supplying oil to machinery while in motion, with much greater regularity under every variation of speed than has hitherto been accomplished.

It consists simply of an oil chamber or reservoir A, from which the oil flows down the short tube or passage *b*, to a plug-tap D, which is interposed between the upper passage *b*, and the lower one or nosel *c*: the latter being inserted in the upper journal or bearing of the shaft or axle to be lubricated. The end of the plug-tap D is prolonged (*e*) to receive a ratchet or other wheel, through which the requisite motion is communicated to it from the prime mover. The plug-tap D has a cap or cavity sunk in a portion of its circumference, which by the rotation of the plug is brought alternately opposite the two passages *b* and *c*; when it is opposite the former it becomes filled with oil, which is discharged as soon as it reaches the passage *c*, down which it flows to lubricate the moving parts of the machine to which it is applied.

As the machine goes faster or slower, so will the quantity of oil supplied to it be constantly proportioned to its rate of working, and the moment the engine stops, the lubrication will stop also.

In these respects Mr. Badcock's engenious contrivance differs from, and in our opinion surpasses all the lubricators with which we were previously acquainted.

## THE THEORY OF THE PERCUSSIVE ACTION OF STEAM.

Sir,—I have read several times, and each time with fresh interest, the paper published in your 946th Number, on the "Percussive Action of Steam;" I have likewise read Mr. Wigney's ideas on this subject, and his New Theory published in your 953rd Number, and offer you now, if you will accept them, some observations on the last-named paper.

I must beg to differ entirely from Mr. Wigney, as to his manner of accounting both for the generation of high pressure steam, and for its percussive action.

I think the percussive action of steam is simply explained by the fact that the effect of any power is in direct ratio to the quickness of its application. Thus, a quantity of steam let on at once is more effective than the same quantity let on gradually. The different degrees of pressure at which steam is generated in boilers, are strongly opposed to Mr. Wigney's opinions, for if "*the superior impulsive power of high-pressure steam is only due to the accumulation of heat in the boiler-plates, and that the immense power of the steam on its egress from the boiler is not innate in the steam while within the boiler,*" why, then, by constructing a boiler with very thick plates, so as to retain a large quantity of caloric, and by generating steam of 4lbs in it, one might create a pressure of 30lbs, to 40lbs in the cylinder when the steam port was opened.

If it be not giving Mr. Wigney too much trouble, I should be glad to hear from him upon what facts he bases his assertion that the *maximum* temperature of steam is 212°, and whether any experiment he has made justifies him in saying so.

Your correspondent further says, "*that he must ever remain sceptical as to the possibility of compressing a volume of steam into a less space than that which it occupies at* 212°." Why, even admitting steam could not be heated more than 212°, this is no reason why it should be incompressible; water, air, &c., are compressible, and why should steam, which is so much subtler than water, form an exception? I certainly do think that steam can be, and is, daily, very much compressed; increase of density is a consequence of compression, and as soon as space is allowed (as in all engines working expansively) expansion follows of course.

I am, Sir,
Your Constant Reader,
SIMPLIFICATOR.

London, November 15, 1841.

APPLICATION OF THE CORNISH ENGINE TO WATER-WORKS.

Sir,—"An Enquirer," in No. 945, has brought forward a subject of interest to the share-holders of water-work companies; but I fancy the positions he has laid down, with some degree of hesitation, will be found untenable. I will endeavour to show that the plunge pump is not an essential part of the Cornish engines, and that it may be adapted for high or low service, though perhaps not with so much facility as the common bucket pump.

It is needless to refer farther to the relative advantage of slow or rapid combustion, as it still appears to be a disputed point. Clothing is different, but that is an old story, and though a theoretical idea in Watt's hands, it has become a practical advantage in the hands of the Cornish engineers.

The proposal for a little higher steam I hold to be extremely dangerous. A little higher steam would soon be required for a little more expansion, and these *little mores* blow up boilers High steam in proper boilers is another question.

In the mines of Cornwall the bucket and plunger pumps are often attached to the same engine, and the exclusion of either variety cannot affect the character of the engine. The question of the relative superiority of these pumps is another point, that may, however, prove of interest to parties engaged in the supply of water to towns.

Recently the old stand pipe has been introduced, in lieu of the air vessel, and the water is driven up to a height sufficient to overcome the friction of the mains, at the velocity due to the delivery. It certainly appears to me that an adjustment of the power to the load is practicable by several means in plunger pumps: 1. An alteration of the weights of the plunger. 2. The use of two pumps, the second to be added for low service. 3. A weight, movable on a railway, placed on the massive beam of a Cornish engine, to act with the steam for low, and against the steam for high service; and these schemes may be used jointly or separately.

I conceive that the suggested alterations of a Boulton and Watt's engine, recommended by "An Enquirer," are on a par with the conduct of a well known company, who took the money of a manufacturer, and instead of applying it to the purposes intended, employed it in the establishment of a rival factory. I remain, Sir,
Your obedient servant,
S.

MR. WICKSTEED'S EXPERIMENTAL ENQUIRY INTO THE MERITS OF THE CORNISH STEAM-ENGINE.*

To Mr. Wicksteed belongs the credit of being the first to introduce the Cornish high pressure expansive engine into the metropolis (at the East London Water Works), and the first also to set prominently before the public its superiority—for all pumping purposes, at least—over the ordinary low pressure non-expansive engine. The publication before us professes to be a plain narrative—that and no more—of a series of experiments which

* An Experimental Enquiry concerning the relative power of, and useful effect produced, by the Cornish, and Boulton and Watt Pumping Engines, and Cylindrical and Wagon-head Boilers. By Thos. Wicksteed, C. E. 4to. pp. 40. Weale.

Mr. W. made, with the view of ascertaining the "commercial value" of the engine, which resulted in establishing to his satisfaction, that it did truly perform more duty with a given consumption of fuel, than any other. With these experiments the reader is already in some degree familiar, through the reports of which have from time to time appeared in the Transactions of the Institution of Civil Engineers, and the interesting discussions to which they have given rise; but no where have they yet appeared in so circumstantial, complete, and authentic a form, as in the present "plain narrative." Mr. W. leaves to others the task (no easy one, it would seem,) of explaining how the superiority in question arises; and confines himself to simply supplying the data from which "sound conclusions" may be deduced. And so far Mr. W. must be allowed to have laboured with most commendable assiduity, and to excellent purpose. If he but ranks with those who, by much hard toil and much enduring patience, clear and break up the ground for the reception of the seed of science at the hands of other comers, still it is among the very foremost and most successful of this class, that he takes his stand.

The experimental investigation of Mr. Wicksteed appears to us to have been conducted throughout with great judgment and fairness; in this respect more especially, that the boilers and engines were treated of and experimented upon separately, and any mystifying mixture of results thus avoided.

In Part I. "On Boilers," Mr. W. details a series of trials made with the wagon-head boiler of Watt, and the cylindrical ones of more recent construction—trials not of an hour or two, or a day's duration, after a too common but most delusive fashion, but extending through continuous periods of 3400 and 1291 hours —from which it appears that the commonly received opinion of the inferiority of the former, has no just foundation, and that the wagon-head boiler evaporates *more* water with a given weight of fuel, than the cylindrical. With one pound of *small* Newcastle coals of the best quality, a wagon-head boiler evaporated 8·301lbs. of water (from 80°), while a cylindrical evaporated (also from 80°) only 8·258 lbs. of water. The gain by clothing the boilers well (with felt) Mr W. finds to be about $10\frac{8}{10}$ per cent.; and the advantage of quick over slow evaporation, to be about 4 per cent. Now as Watt, more than half a century ago, estimated the average evaporation from Newcastle coals to be "equal to 8·62lbs. of water per lb. of coal, or 8·446lb. from 80° Fahrenheit," Mr. Wicksteed considers the difference between the two sets of results to be so trifling, as fully to justify him in coming to the general conclusion, "that very little, if any improvement, has been made in the evaporative power of boilers, since the days of the great, the immortal James Watt." We are as great admirers of Watt as Mr. Wicksteed can possibly be, and are inclined to set as little store as he does, on the advancement made in the construction of boilers from the time of Watt, down *to the date of Mr. Wicksteed's Experimental Enquiry;* but we must not forget to put in a word for the new light, which has been just thrown on the whole subject, by the investigations of Mr. C. W. Williams, which have filled us with the most perfect assurance that the evaporative powers of boilers, whether wagon-headed, cylindrical, or of any other (external) shape, are about to be increased to an extent of which even the Great Watt never dreamed.

On the experiments described by Mr. W. in Part II. "On Engines," we must refer to the work itself; contenting ourself with making here one or two suggestions for the author's consideration:—

Page 22. We think the alteration of the equilibrium valve, from the bottom to the top, would no doubt be "advantageous," when there is no cushion or compression of steam; but it would reduce a little the power (not the duty) of the engine, because there would not be so great a bulk of steam to expand.

Page 23. In Mr. W.'s calculation of "useful effect," we think he has erred in deducting the *whole* of "the area of the piston rod," from the area of the piston, because, although the steam cannot press upon that part covered by it, on the in-door or down stroke, the pressure of the atmosphere takes effect on the top area of the piston rod, there being a vacuum beneath the piston. The deduction should be the difference between the loss of steam pressure on the area of the piston rod, and the gain of the atmosphere On the "out-door stroke" there is,

against the Cornish engine, 15—6·75; Boulton and Watt's, 15—9·28; but on the "in-door stroke" there is, in favour of the Cornish engine, 15—·73, and of Boulton and Watt's, 15—·49. We need not go into figures to show the power omitted in this erroneous estimate, but which the engine really exerts, over and above the power determined by Mr. Wicksteed's calculation.

We may observe also of his tables, that our dependence upon their value is lessened by the mixture of the theoretical columns with the practical ones; a little more labour, and we might have had far more valuable and certain results.

It is necessary, in conclusion, to observe, that both the engines upon which Mr. Wicksteed's experiments were made, are pumping engines. The much disputed question of the causes of difference in duty, between the pumping and rotative engines, is not advanced an inch by Mr. Wicksteed, who in his preface observes, "those who know the difference between an engine for giving motion to machinery, and one for simply raising water, must be well aware that the same useful effect cannot be produced by the former as by the latter, with the same consumption of fuel." Why? Mr. W. gives no reason. Will none of our engineers, then, take this very important question in hand, and endeavour to bring the rotative to the same perfection in economy of fuel, as the Cornish lifting engine.

## ELECTRO GILDING AND PLATING.

Sir,—Perceiving in your Magazine (No. 949) the abstract of a patent, taken out September 29, "*for certain improvements in the production of works of art in metal, by electric deposition,*" and as these improvements are precisely those communicated by myself to the London Electrical Society, (at their meeting on Tuesday, September 21, being *before* the date of the said patent,*) and reported in the public journals, I have thought it right to send you a copy of my communication, in order to show that the claim of priority of discovery is due to myself rather than to any other.

I have marked in the margin those passages which are especially identical with the claims of the patentee of the "improvements," &c., alluded to, viz., the using a battery and depositor *in* moulds, backing them up with copper.

I have not time, nor, if I had, would it be just to trespass upon your pages with my opinions upon the many patents taken out for electrotype; for them I must refer you to "Electrotype Manipulation," part 2; but with reference to the patent in question, it would seem that it cannot be tenable, for the *solution* employed, is one already patented by Elkington, viz., the *cyanide.*

My object in writing this is rather to establish that claim of priority to which each successful experimentalist is entitled, than to interfere with any claim which may promise a lucrative return to patentees.

I remain, Sir,
Your obedient servant,
CHARLES V. WALKER.

Kennington, October 22, 1841.

We subjoin the passages of Mr. Walker's pamphlet, marked by him on the margin, as confirming his claim to priority of invention, and also one or two others which we deem of importance. We have no hesitation in saying that so far as the matter of publication goes, they establish, to our satisfaction, that claim most fully. Neither have we any doubt that the modes of electro-plating and gilding, described by Mr. Walker, are, so far as Mr. Walker is concerned, entirely original. ED. M.M.

"Like others, I made some attempts at plating, immediately after the publication of Mr. Spencer's paper; and by means of a solution of nitrate of silver, and a fine point as an anode, succeeded in obtaining, so far as I am aware, the *first* specimen of the deposition of silver. I was not at that time intimate with the relation subsisting between the size of the anode, the strength of the solution, and the electro-motive force of the generating cell; and was so occupied with another series of experiments, that I did not attempt to investigate the causes, which, in that instance produced a successful result; and those, which in one or two other instances, produced the reverse.

"Many have turned their attention to this subject, as well as to gilding, and with various success; but, contrasting the number of labourers in this field of inquiry, with its value and importance, not nearly so many have

* This is an error; the patent was dated March 29; specification enrolled Sept. 29.—[ED. *M. M.*]

been occupied as might be imagined. And of those who have been thus engaged, the object has been accomplished at the expense of the *salts in solution*, and not at the expense of the *metals themselves*. It is obvious that this is not the most economical mode of procedure, because it includes, first, the labour and expense of producing the salts, and then the expense of releasing them from their solution. But as this plan had been so generally pursued, I was led to imagine that there existed some practical difficulty in producing electro-chemical union between the anions and the anode, and this opinion was the more confirmed, when I found that the firm in Birmingham, who have patented the employment of solutions of the cyanides of the noble metals, mention in their specification, that 'it will be found necessary to add, from time to time, a fresh supply of oxide to the solution, in order that they may be kept saturated with that salt;' indicating that they plate and gild at the expense of the *oxide* of silver and the *oxide* of gold, and not at the expense of the metals only. In reviewing the labours of others, I find the same general principle prevailing; some have used one salt, and some another, but all have obtained their results at the expense of the *salt* employed. I may except from this, Mr. Smee, who, in *plating*, employed a *silver* wire as an anode, but in *gilding* he used a *platinum* wire.

* * * * *

"Finding, then, no further account of experiments on this subject, I was led to reflect on the elements evolved at the positive electrode, in the electrolysis of a solution of cyanide of silver, and they seemed to be such as might combine with a silver plate under the influence of a current of electricity. And from the readiness with which salts of silver are decomposed, it seemed best to employ but a feeble power, or, in electrical language, a low intensity. For this purpose I excited a pint cell of Daniell's arrangement, using the zinc unamalgamated, in a solution of salt and water, and prepared a silver solution by first dissolving an ounce of the cyanide of potassium in half-a-pint of water, and then adding about the eighth of an ounce of oxide of silver. This solution was placed in a tall flat glass cell.

* * * * *

"A wire, in connexion with the copper of the battery, was united to a plate of silver an inch wide; the silver was made to dip just beneath the surface of the silver solution. An electrotype copper medal was then perfectly cleared, bathed in a solution of water containing a few drops of nitric acid, washed and polished. To this was attached a wire connected with the zinc of the battery. Having assured myself that the battery action has commenced, (and this is most important,) I immerse the medal in the silver solution for about ten or twelve seconds, when it will be covered with a thin coating of silver. It is then removed, and after being dried it is polished with a fine leather, or soft cotton, and is again placed in connexion with the battery to receive a second, and again, to receive a third coating. The whole is effected in a few minutes. It is not necessary to dwell here upon the management of the article to be plated; there is a certain degree of care necessary, but this is common to plating by any process, and may soon be acquired by a little practice. It is to the action occurring at the anode, that I wish to direct the attention of members. At the anode is released from the solution the compound gaseous body termed carburet of nitrogen; but, (from its singular property of combining with elementary substances, as though it were elementary itself,) also termed *cyanogen*, to show its relation, in one sense, to the other gases. This, instead of escaping, combines with the silver, as the oxygen does with the copper plate, in the arrangements now generally adopted in the production of precipitations of copper, and a supply of silver is thus furnished to the solution, precisely equal to the quantity deposited upon the surface of the negative electrode, or object to be plated. The plate of silver submitted to the society, is that which was employed in plating the collection of medals now on the table. It will be seen that the lower portion is wasted away by the action of the cyanogen. And from the appearance it presents, an opinion may be formed of the great saving of expense by the adoption of this method. After the first outlay for a generating cell, and a solution of silver, all future expense is simply confined to the time employed, and the actual quantity of metal consumed.

* * * * *

"Having been thus far successful in *reducing the expense of plating to a minimum*, I next endeavoured to accomplish the same for gilding, and with equal success. As precisely the same manipulation is required, the observations made with respect to plating are equally applicable here. In addition, I would observe that the deposits of gold are not obtained in so few seconds as those of silver, and that the solution of gold contains a little less of the oxyde than does the silver solution. In other respects their composition is the same.

* * * * *

"Among the specimens on the table before the Society is a set of medals thus gilded and also the gold anode employed. The latter consists of a stout gold wire, from the lower end of which has been consumed a portion, equivalent in quantity to that obtained on the surfaces of the medals. Before deposit-

ing gold on the surface of objects, it may be advisable to plate them with one layer of silver; this can be accomplished in a few seconds, and will furnish a clear and desirable base on which to deposit the gold; besides, by first burnishing this layer of silver, less waste of gold will be caused, as there will not be need of so much polishing for the gold surface, it will take a character from the silver beneath it. As in manipulating with silver, so with gold, a regulating apparatus may be introduced whenever the nature of the operations shall require it. And thus I conceive *the expense of gilding is reduced to a minimum.*

"It will be well to remark in conclusion, that the most simple mode of obtaining a gold or silver surface, is to deposit these metals in the moulds, and then on these to deposit copper. This is not practicable in applying the process to the ordinary arts, but is eminently so in the production, by the electrotype process, of objects in metal moulds. A collection of medals may be formed in this manner, without the least need of cleaning or burnishing, processes which consume considerable time."

### MANCHESTER EXPERIMENTAL DEMONSTRATION OF THE EFFICACY OF MR. WILLIAMS'S SMOKELESS FURNACE.

We mentioned lately that a specimen furnace was in course of erection in Manchester, by Messrs. Dircks and Co., Mr. Williams's sole agents, for the purpose of public inspection. The furnace was set to work for private inspection for three days, commencing on Monday, the 15th ult. It was visited by the Mayor and the principal public authorities of the town, as well as by many eminent engineers. On the 18th it was, agreeably to advertisement, thrown open to the public, admission being given by ticket. On Friday, the 19th, the Nuisance Committee of the town were present by appointment, and witnessed the whole operation of charging the fire, and of using and disusing the patent apparatus, which, as our readers are aware, lies in a small chamber behind the bridge, and constitutes the only material difference between this and a common furnace. It was made to give off abundance of smoke, and then, without the least delay or trouble, was reversed, and made so to act as to burn all the gaseous products of the coal, without any emission of smoke. No caution whatever is displayed in the exhibition: the furnace is so built that it can be viewed on all sides, and it is beset with sight-holes, fitted with glass, by which to see into the flues, and into the chamber where the perforated apparatus for admitting air through about 1200 very small orifices, may be distinctly seen, as also the body of gas-flame playing under the bottom of the wagon-head boiler set up with the furnace, much in appearance like the beautiful experiment popularly styled the "fire-cloud." At the close of the repeated operations of making and of preventing smoke, Mr. Dircks and the company of gentlemen present, stood by one side of the furnace, on which was chalked a full sized section of the plan of its construction. Mr. Dircks went into a detailed description of the management of the whole, and the operation (as chemically and practically considered) of the combustion of the fuel on the bars, and of the coal gas in the chamber, when saturated with a due quantity of atmospheric air. The increase of smoke was stated to be dependent on the decrease of the atmospheric oxygen, by so much as it falls below the proportion of ten cubic feet of air to one cubic foot of gas—chemistry teaching us that bodies unite only in certain measured proportions, and that with more or less of the one or the other of two ingredients, we have a favourable or an unfavourable result. Mr. D. dwelt particularly on the necessity for the rapid, and at the same time intimate, admixture of the air and the gas, as otherwise there would be portions only wastefully burnt. He illustrated this by the well known fact, that in the galleries of coal mines, there will be an upper inflammable stream of gas and a lower stratum of common air, enclosed in the same passage, but gliding passively only; they have however, he observed, to be intimately blended, and we should have a mixture which would, in an instant, be ignited over acres of surface. Mr. D. explained how that in this furnace the gas could scarcely escape the most intimate admixture of which the hurrying process in a furnace would admit, and that the absence of the smoke offered the best proof, whether Mr. Williams was not, both theoretically and practically, right in the view he took of the subject. Mr. Dircks contended, also, that there was great fallacy in the notion that hot air is advantageous; it might be so to a common furnace, but not so in one contrived to burn the gas by admitting

atmospheric air. Hot air, he thought, would do very well for the solid carbonaceous fuel on the bars, but it was of no use bringing hot air to the *gases;* it was oxygen that was wanted, and it was notorious that a foot of hot air could not contain as much oxygen as a foot of the coldest air. "What we want then," said he, as Mr. Williams has often stated, "is just the reverse of what is commonly sought after, that is, we require the *gas* as *hot* as it can be obtained, and the *air* as *cool* as it is naturally supplied, for we effect, by this chemical process of combustion, a temperature much higher than we could possibly bring about by any mere artificial process of heating the air."

The company separated expressing their great satisfaction with this practical illustration of what can be done in the way of *preventing*, and of course superseding the necessity of "*burning*" smoke.

We understand that deputations are being formed in other manufacturing towns to visit this furnace, which is one of full dimensions, with a boiler complete, very neatly and compactly fitted up. —*From a Correspondent.*

[That this invention should excite so much attention in our manufacturing towns, is no more than might be expected, considering at what a sacrifice of health and comfort those manufactures, from which they derive their wealth, are carried on—how wasteful of health all the ordinary methods of combustion are;—and how entirely the system of Mr. Williams promises to put an end to the smoke nuisance—while at the same time it is calculated to extract, from whatever sort of fuel is made use of, the utmost amount of heating power of which it is possessed. Among the visitors at the Manchester exhibition described by our correspondent, was Mr. William West, of Leeds, a gentleman who, if not much known out of his own neighbourhood, enjoys a well-deserved celebrity there for chemical knowledge and skill; and in a letter which we have seen from Mr. West, he speaks in the following very commendatory terms of Mr. Williams's invention:—

"Residing in Leeds, a town noted for abundance of smoke, and consequent dirt and insalubrity, I have long been attentive (either as employed professionally, or as a question of science,) to the *burning* of smoke, and have on various occasions expressed opinions not very encouraging to exertions for that end; but *preventing* smoke is a different and very superior object; and it appears to me that Mr. C. W. Williams has been the first clearly to point out the means by which smoke may be *prevented*, and to apply those means to practice. * * * The mechanical arrangements for effecting the separate combustion of the volatile and fixed portions of the coal completely, so as to prevent the formation of smoke, and advantageously, so as to ensure the greatest heating effect, seem to be very judicious; and it is to be hoped that no one will, either in surreptitious attempts to evade the patent, or ill-judged endeavours to improve it, copy part of the details, at the expense of the principles of the discovery." Ed. M. M.]

## THE "KAMSCHATKA" RUSSIAN STEAM FRIGATE.

The hint we recently threw out, that we should be glad to receive some particulars of this vessel, which has been built and fitted up in the United States for the Russian government, and much talked of as being a perfect *chef d'œuvre* of steam marine architecture, has been attended with all the success we could desire. It has led to our being favoured not only with drawings of the vessel and her machinery, but with most minute descriptions of every thing about her, from both American and English sources. We propose now—first to describe, in a general way, such of the drawings sent us as we have thought it necessary to have engraved—then, to insert the descriptive and critical communications which accompanied them, giving the precedence, as in courtesy bound, to what the Americans themselves say of their own handy-work—and, lastly, to subjoin some general observations of our own.

### *The Engravings.*

Fig. 1 is a sketch of the vessel as she was seen at Southampton, after her arrival from America.

Fig. 2. A deck plan.

Fig. 3. Plan of the boilers, four in number, with four fire-places to each.

Fig. 4. End view of the paddle-floats.

Fig. 5. A sketch of the general arrangement of the machinery.

Fig. 1.

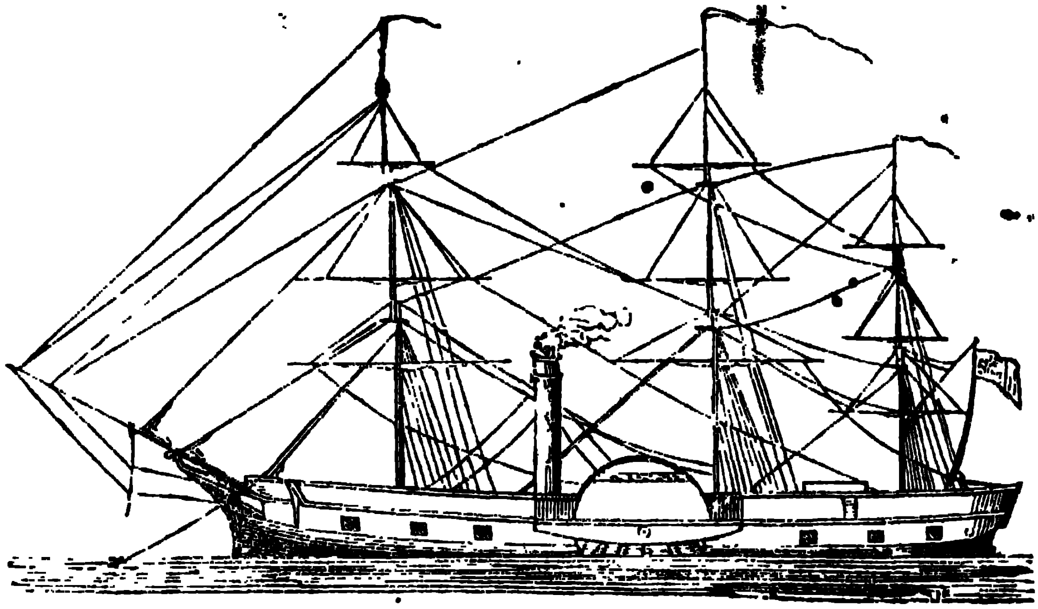


Fig. 2.

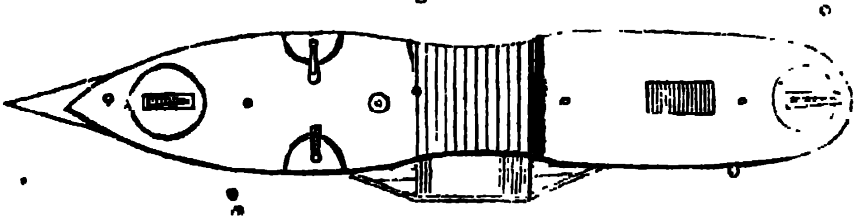


Fig. 3.

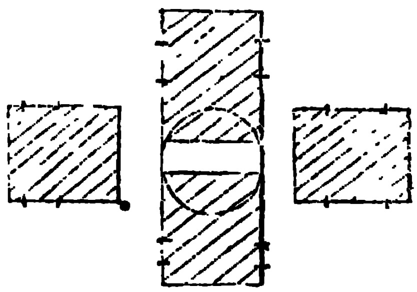


Fig. 5.

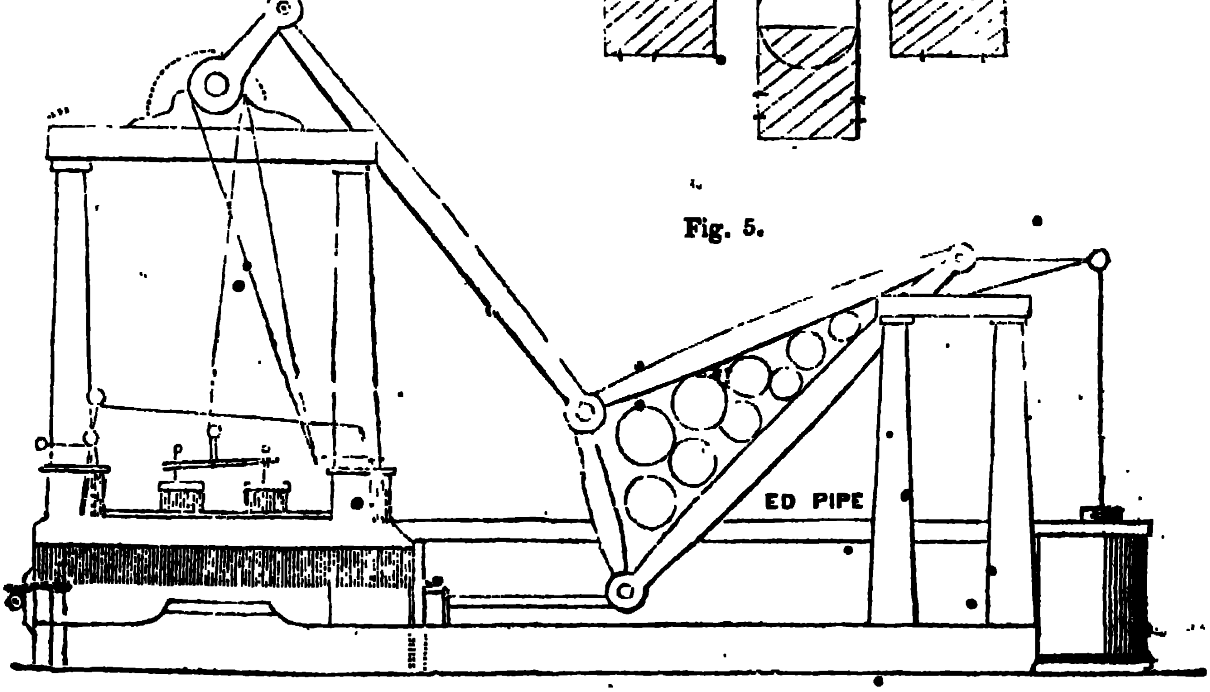
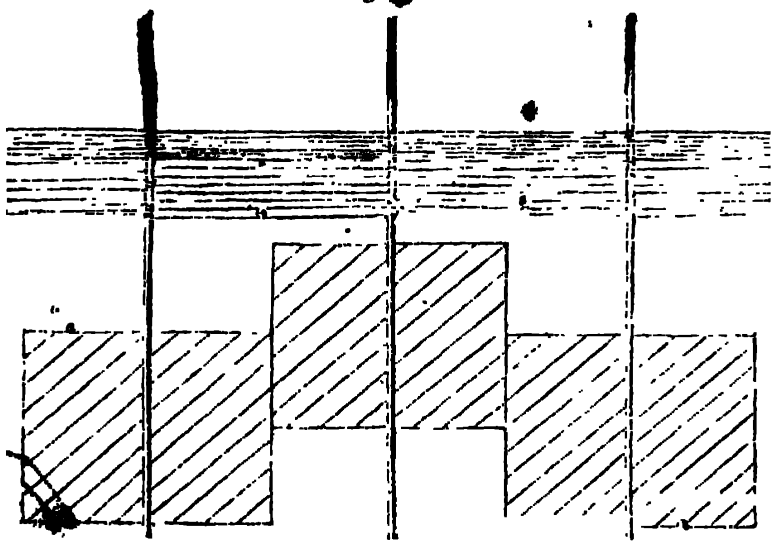


Fig. 



*American description.*

(Stated to be extracted from the *American Repertory.*)

The *Kamschatka* was constructed for the Russian government under the superintendence of R. and G. L. Schuyler, by whom the engines and machinery were selected and arranged, and the modelling of the hull principally directed. The hull was built by Mr. W. H. Brown, the boilers, engines, and machinery by Messrs. H. R. Durham and Co., and for a city famed as is New York for excellence in ship building and manufactures, it is no faint praise to say that a craft never left her docks superior to this, in finish and goodness of materials.

We have been kindly furnished from the two departments, with the necessary information for preparing the following description and tabulated statement.

The *Kamschatka* is one of the largest steam frigates that have yet been built; she carries in all 16 guns—12 thirty-six pounders on the gun-deck, 2 sixty-four pounders, and 2 ninety-six pounders on the upper deck. The latest improvements in ship building were preserved in her model, and between decks the arrangements were but little modified, except so far as they were affected by the introduction of steam machinery.

There are two engines of the kind, designated technically the half-beam engine, which turn the water-wheel shaft by cranks at right angles to each other. The cylinders are horizontal, and lie in the bottom of the ship; motion is communicated from the piston to the shaft through a bell-crank, one arm of which is connected with the piston-rod and the other with the shaft. The whole of the working parts are within a connected cast iron frame, which supports them, 26 feet long, and 24 feet wide, firmly secured by wrought iron bolts and stays, passing in directions of the several strains, and through the entire bottom of the ship. The shafts and cranks are of wrought iron. The engines are worked by double balanced valves, and valves of the same kind are used for cutting off steam, being arranged so easy of adjustment as to require but five minutes to set or alter them, to cut off at any part of the stroke for which the cams are graduated.

The wheels combine the advantages of the double American paddle-wheel with the buckets of one division intermediate between those of the other and the cycloidal wheel, the buckets being divided into two parts, which are placed one above the other on the opposite sides of the arms. The arms and braces are of wrought iron. The boilers are of copper, built on the flue and tubular principle, and possessing, in an eminent degree, the advantage of both. The tubes receive the heat direct from the furnaces, and from them it passes through large flues in its passage to the chimney. The boilers are constructed for burning anthracite without the use of blowers. The space occupied by the boilers, engines, and fuel is separated from the rest of the vessel by wrought iron bulk-heads.

| | ft. | in. |
|---|---|---|
| Diameter of cylinders ............ | 0 | 62 |
| Length of stroke ................ | 10 | 0 |
| Cut off .........from 1ft. 10in. to | 7 | 10 |
| Average pressure of steam ...... 5lbs. | | |
| Vacuum per barometer............ | 0 | 27 |
| Number of revolutions per minute, leaving port ................10 | | |
| Number of boilers ..............4 | | |
| Space fore and aft occupied by boilers and engines............... | 70 | 0 |
| Diameter of water-wheels ........ | 30 | 0 |
| May be reefed to ................ | 28 | 0 |
| Length of bucket, including both divisions of the wheel........... | 9 | 6 |
| Width of buckets {upper float 12in. / lower ditto 9in.} | 1 | 9 |
| Dip of bucket ................. | 5 | 6 |

| | | |
|---|---|---|
| | ft. | in. |
| Diameter of shaft journals ........ | 1 | 4 |
| | Tons | |
| Weight of shaft and cranks, rough.. | 38 | |
| ——————— finished | 30 | |
| Weight of water-wheels .......... | 32 | |
| Ditto of boilers, smoke-pipe, and breeching .................. | 90 | |
| Total weight of engine and boilers .. | 450 | |
| Weight of cast iron .............. | 235 | |
| Ditto wrought ditto .............. | 120 | |
| Ditto copper and composition ...... | 95 | |
| | ft. | in. |
| Length of keel................... | 205 | 0 |
| ——— ship at load water line .. | 212 | 0 |
| ———upper deck ............ | 220 | 0 |
| Breadth of beam at load water line.. | 36 | 0 |
| Depth of hold ................... | 24 | 0 |
| Draft of water, loaded............ | 16 | 0 |
| | Tons | |
| Burthen ...................... | 1700 | |

It was the design of Messrs. Schuyler to make a full trial of the *Kamschatka's* qualities as a sailer, both by steam and wind, before she left our waters, but from the lateness of the season it had been abandoned. Her commander was anxious to reach Cronstadt before the passage of the Baltic became hazardous.

*English Account.*

The *Kamschatka*, Russian steam vessel, circular stern, Captain Von Schautz, from New York to Southampton $22\frac{1}{2}$ days.

| | ft. | in. |
|---|---|---|
| Length in load water line ........ | 210 | 0 |
| Breadth for tonnage.............. | 37 | 0 |
| Depth in hold .................. | 24 | 0 |
| Burthen in tons ............ 1430 | | |
| Draught of water with 670 tons of coal on board .................... | 16 | 8 |
| Displacement at ditto .... 2470 tons | | |
| Height between decks ............ | 7 | 9 |
| Diameter of paddle-wheels ........ | 30 | 0 |
| Breadth of ditto ................ | 10 | 0 |
| Number of revolutions per minute 12 | | |
| Speed (per calculation) .... $9\frac{1}{2}$ miles | | |

*Armament.*

| | | Pounders. | |
|---|---|---|---|
| Upper deck | No. 2 | 90 | Pivot. |
| | 2 | 56 | Broadside. |
| Lower ditto | 12 | 36 | Ditto bored up 24 pounders |

Centre of shaft 9 feet above centre of floatation.

Height of engine beams 36 inches.

*Frame* converted from *live oak* below, and *white oak* and *locust* abaft. Planked with Canada elm. White oak and pine *wales*, 8 inches thick, scored on the frame 1 inch, fastened with copper thorough bolts and treenails every 9 inches.

*Upper deck.* Beams 11 inches by 12 inches, secured by two lodging and one hanging knee of wood, (no shelf pieces.)

Cost of vessel complete for sea, including engines and copper boilers...... £120,000

Copper boilers................ £ 22,000

*Engines* very complicated, and, with the boilers, stand high, and much exposed to shot.

*Horizontal cylinders* $62\frac{1}{2}$ inches diameter, and 10 feet stroke. Steam cut off at half-stroke. Boilers constructed as locomotive, with pipes $7\frac{3}{8}$ inches diameter. A great deal of complication to work the valves, and no coal boxes abreast the engine.

The principal part of the coals stowed afore and abaft the engine-room, and transported to the stoke hole by railways at the side, which causes the engines and boilers to be much exposed to shot. The whole of the deck afore and abaft the paddle-boxes (outside) entirely washed away from being laid close.

*Second English account.*

Vessel and engines:—

240 feet long on deck, 210 at the water line, drawing 16 feet water, which was her draught on leaving New York with 670 tons of coals on board. Beam 38 feet. Depth of hold 24 feet. Displacement 2468 tons.

The vessel drew, on her arrival here, $13\frac{1}{2}$ feet water, having then 80 tons of coals on board, and having taken 670 tons on board at New York, she must have consumed 590 tons of coals on her passage. The entire time occupied from leaving New York until her arrival here was 22 days, out of which she sailed three days, leaving 19 days steaming, so that her consumption of fuel every 24 hours must have been $\frac{590}{19} = 31$ tons.

The paddle-wheels, on leaving New York, were 30 feet diameter, but were reduced to 28 feet during the passage, making their average diameter 29 feet.

The paddles are 10 feet long, and equal to 2 feet wide, and it appears the average speed of the engines was about ten strokes per minute. The cylinders are $62\frac{1}{2}$ inches diameter, and the length of stroke is 10 feet, and at ten strokes per minute. Assuming, then, 7lbs. per square inch of the piston for the effective pressure, and 33,000lbs. raised 1 foot high for the horses-power, the power of each engine will be 130 horses.

There are four copper boilers disposed in the vessel thus, (see Fig. 3.)

The pressure in the boilers is 7lbs. above the atmosphere, and the engines are provided with expansion valves, by which the steam can be shut off at such part of the stroke as may be deemed advisable. The external cases of the boilers are of a square form, and the internal construction is after the system of the locomotive boilers, as used on

the railways, the tubes being 2 feet long, and 1¼ inches internal diameter, and placed in uniform horizontal and vertical rows, and very close together. The cylinders are placed in a horizontal position upon a strong cast iron framework; the main shafts being placed immediately over them are supported by the same system of framework which supports the cylinders, and there are two sets of steam and eduction valves at each end of the cylinder. The end of the piston-rod is retained in its position by a cross-bar and horizontal guides, and its reciprocating motion is conveyed by a connecting link to a bell-crank, the centre of motion of which is suspended at a considerable elevation by a second heavy cast-iron framework, and the motion is conveyed from another arm of the bell-crank by a connecting-rod, in the usual way, to the cranks.

The air-pump is worked by an horizontal lever projecting from the centre of the bell-crank, thus, (see fig. 5.)

The weight of the boilers, with steam-chests, pipes, and chimney, is 100 tons, with 50 tons of water additional; and the weight of the entire apparatus, with water in the boilers, is 500 tons.

*Observations.*

If the *Kamschatka* may be truly regarded as a fair specimen of the degree of skill which our American friends have attained to in marine engineering, we do not think the engineers of their mother land have much to fear from their rivalry. Her defects, indeed, are so great, as to have taken us quite by surprise. We could not have believed, except on such unquestionable evidence as that now before us, that a country which at first took the lead of all the rest of the world in steam navigation—which is at this day only second to Great Britain in the number of her steam ships, could have fallen so far behind in the art of constructing them. We make bold to say, that it would be easier to produce fifty vessels of English building and fitting-up, incomparably superior to this American masterpiece, than to show one provided with machinery of so rude, so ill-contrived, so complicated, so cumbrous, so inefficient, a description. Although her engines and boilers produce but the effective power of 260 horses, their weight is 450 tons, which is more than double what a pair of English-made engines and boilers of equal efficiency would weigh. The consumption of fuel, in the passage across the Atlantic, was equal to nearly 12 lbs. per actual horse-power per hour, which is also more than double the average consumption of our crack English steamers. Look again to the disposition and details of the machinery—the *horizontal* cylinders and pistons — the nicely-arranged valves, which "require but *five minutes* to set or alter" — the antiquated bell-crank movement, with its separate enormous framework—the very original and fore-fingerish style of working the air-pump, &c.—why, the whole affair presents matter for merriment, rather than serious criticism. Brother Jonathan! Brother Jonathan! you may depend on it, that, with all your "going *ahead*" notions, you are, in respect of the matter at present in hand, a "tarnation" way *astern*.

MR. WILLIAMS'S RESEARCHES ON COMBUSTION. PART II.

SIR,—Having lately published the first part of a Treatise on "The Combustion of Coal, Chemically and Practically considered," and having had many applications for the forthcoming Second Part, which is intended to illustrate the practical application of the principles on which I have dwelt, I find myself unable to send the Second Part to press with the expedition which my own wishes, and the nature of the enquiry, would suggest. This delay is occasioned by the difficulty of devoting the necessary continuous attention to the subject which a preparation for the press demands, and from a desire of including those corroborative proofs which experiments on a large scale can alone satisfy.

Under these circumstances, I propose, with your permission, continuing, through the medium of your widely circulating columns, to give detached papers on the leading points of this interesting subject, and in anticipation of the forthcoming Second Part. By this means, the several topics will be brought forward in a way most likely to create useful

discussion, and therefore most likely to be useful.

Thanking you for the ready insertion given to my late communications and diagrams in your last five numbers, I beg to forward you a continuation of my views on the means of increasing the evaporative power of boilers.

I am, Sir, &c.,

C. W. WILLIAMS.

November 29, 1841.

*On increasing the Evaporative Power of Boilers. By C. W. Williams, Esq.*

In my last communication, inserted at page 410, I referred to the alleged burning of the metallic conductors which I insert into the flue-plates of boilers, to increase their evaporative powers. This enquiry as to their supposed "burning away," is so intimately connected with that of the transmission of heat through the plates of ordinary boilers, as it affects the durability or deterioration of the latter, that it demands a special notice, and particularly as it is of so essentially practical a nature.

The conductibility of heat through metallic bodies need not be dwelt on; the point for present consideration is, the degree of heat to which conductors of any kind may be exposed, and the measure or quantity of heat which can be transmitted in the way of conduction, as well by rods as plates, without affecting them injuriously.

The two modifications of the conducting power of metals, to which I have already referred, are the transverse and the longitudinal. By the former, heat is conveyed transversely, that is, in a direction at right angles with the surfaces of plates, and, as it were, across the lines of their fibrous construction or arrangement. By the latter, the heat is conveyed longitudinally, or in a direction parallel with those fibres. The one, therefore, manifestly refers to plates, and the other to rods or bars. How far the ratio of conductibility in the metals whose structure is of a fibrous character, and susceptible of polarity, (as, for instance, iron,) may vary, when the course of conduction is in the direction of those fibres, or transverse to them, is not now to be enquired into, although highly deserving of investigation. For the present, we will assume that there is no difference, although I by no means assent to the hypothesis. The question before us is this alone,—to what extent, practically, may we push this conducting faculty, without affecting the strength or durability of the metal?

On this head, my experience leads me to conclude that so long as the heat is transmitted through the metal, (transversely or longitudinally,) in the same quantity and with the same rapidity that it is received by it, the metal may be considered as a mere carrier, and will remain unaffected. And this may be taken as irrespective of the temperature, quantity, or intensity of the heat so transmitted—at least so far as regards furnaces in which combustion is urged by mere atmospheric pressure, and not by the concentrated energy of an artificial blast.

For the present enquiry, we will consider heat as a matter or body, (though not as a ponderable one,) and in the same sense as when we speak of the electric fluid passing through bodies. If then this "matter of heat" find a passage *through* iron plates, with the same rapidity that it is received *by* them, the metal will remain uninjured by such transmission. If, however, from any cause it be delayed, or obstructed in its passage *through*, or exit *from* the metal, accumulation instantly takes place, a new state of things will be induced, the relation of its parts or atoms (among themselves) will be modified, and the metal will be affected injuriously or otherwise according to circumstances.

Now, this view of the subject of conduction requires that we distinguish strictly between the duties performed by the transmitting body on the one hand, and the body to which the heat is transmitted on the other. In other words, we must discriminate between the faculty with which the metal is endowed for transmission, and that of the recipient for reception; and the rate at which this latter is enabled to take up or absorb the heat so delivered to it. The distinction here drawn is of the last importance, practically, as we shall find that the capability of the *receiving* body exercises a much greater influence in our ordinary evaporative operations, than that of the *transmitting* body; an influence which, as I shall hereafter show, is usually attributed to a wrong source.

But let me first clear the way, by pointing out some practical errors very ex-

tensively prevalent. In the communication of *force*, by percussion or pressure, the communicating and receiving bodies are equally affected; the same measure of force that is given by the one, being received by the other—the action and re-action being equal. Not so, however, in the transmission of *heat*, since each body will be found to have its own laws, measures, and rates of transmitting and receiving, or absorbing; each of which is affected by numerous special conditions as to time, temperature, quantity, and effect. We must not stop, however, to examine these details, but refer merely to the fact, as bearing on the subject before us, namely, the liability of the plates of boilers, or their metallic conductors, to deterioration, by reason of the quantity of heat, or rate of transmission, to which they may be subjected, and which are to influence their evaporative functions.

In the case of boilers, water is so excellent a *recipient* of heat, though not considered a good *conductor*, (an hypothesis which I most respectfully deny, seeing how universal is the assertion,) that the rate of transmission through the plate, or other conductor, will not be impeded; that is, the rapidity with which heat is conducted through a metallic plate, (which rapidity is essential to its preservation,) will not be impaired by any delay or obstruction, on the part of the water, in taking it up. With such a recipient then as water, no injury can be sustained either by the surface plates or conductors, though exposed to the most intense heat of a furnace. Since injury to boilers, therefore, does not arise either from deficiency in the transmitting power of the metal, or receiving power of the water, we must look for its cause from some other source.

The most intense heat which can, practically, be found in a furnace, is that produced by a highly charged coke or anthracite fire, when in full action. If water remain in contact, and merely by its own gravity, with a metallic plate, though the latter be exposed to the full action of this elevated temperature, the heat will be absorbed as rapidly as it can be transmitted, and in whatever quantity, while the plate will remain absolutely, unaffected and uninjured; but if any body, whose *receiving* power shall be inferior to that of water, be interposed between it and the plate, or if any accidental obstruction to the passage of the heat through the metal should intervene, a delay in the transmission will be induced—accumulation of heat in the metal will immediately take place—the plate will become overheated, softened, and ductile—expansion will follow—and hence, if there be any internal pressure from steam, warping, bulging, or rupture, will ensue.

Let us now examine some of the ordinary causes of this interruption in the transmitting power or delay in the recipient power of the bodies in question—iron and water.

Injuries to boilers are most usually attributed, firstly, to mismanagement or overcharging the fires, or the mal-arrangement of the furnaces; secondly, to neglect in maintaining the due supply of water; thirdly, to that incrustation or deposition which settles on the interior of their plates, and deranges the conduction and passing of the heat through them; fourthly, to an undue pressure of steam. As to the first source of injury, I consider it quite groundless. No damage can be done to the boiler by reason of excessive heat, or from any other cause connected with the fuel or the furnace, beyond the ordinary wear and tear, provided due attention be paid to the mere circumstances, of preserving the interior in a proper state of cleanliness, (of which I will say more hereafter,) and maintaining the water at its proper elevation. I have made every effort to injure the bottom and flues of boilers by all degrees of temperature in the furnace, and all sorts of changes in the situation and management of the fuel, but without producing the slightest effect, when these two conditions are properly attended to.

With respect to the second source of enquiry, "allowing the water to fall below its proper level," nothing need be said on the subject—its consequences are too manifest to require comment. The third source of injury, incrustation, demands a closer investigation. The reasoning on this head most prevalent, is, that the incrusted deposit which adheres to the plates in the form of a solid hard crystallized body is a bad conductor of heat; and that owing to this circumstance the plates on which it is deposited, if exposed to the strong action of the fire, as in the bottom of cylindrical boilers, has a tendency to become over-heated or burned.

It is by many supposed that this incrustation being suddenly separated or driven off, and occasionally in large quantities, the water is thus as suddenly brought into contact with the supposed overheated plates, that a sudden and commensurate generation of steam is the consequence, and that expansion, bulging, rupture, or even explosion, may ensue. To the entire of these allegations, and the inferences drawn from them, I demur, as inconsistent with the real state of things, and irreconcilable with the laws which govern the transmission of heat. In my next communication, I will offer some direct proofs on this subject. I am, Sir, &c.,

C. W. WILLIAMS.

Liverpool, Nov. 30, 1841.

## PRACTICE AND PRACTICIANS, *versus* MATHEMATICS AND MATHEMATICIANS.

Sir,—Mr. Pilbrow is not entitled to say, or to infer, from anything I have written in your Magazine, that I entertain any "doubt of the accuracy of mathematics," or that "if the data and principles are sound, the deductions of the mathematician will be sound also." I deny it not—the data *may* be, and the demonstration *must* be sound and true; but it is too apt to be forgotten that the conclusion belongs to abstract, or to conditional truth, and may not, and indeed seldom can be, the truth of reality after all. And why is this? not because the premises are incorrect, or the logic exceptionable, but because the *whole* of the data may not, and, in truth, with the exception of the simplest cases, cannot, by any possibility, be comprised in the problem, so as to elicit a conclusion conformable to the actual result. No calculus, within the reach of human intellect, can work out the problems generally connected with practice, and which practical men are continually being called upon to grapple with, after their own peculiar manner; nor is it too much to say that whatever progress the mathematics may be destined to make, the full accomplishment of such a task is, by the constitution of man's nature, for ever placed beyond his power.

It is *matter* in its thousand Protean changes that the practical man has to deal with, and not the mental conception of quantity in a few simple and direct relations. It is true—at least sound metaphysical considerations indicate it to be a truth—that such changes do not proceed from various qualities in matter, working occultly after their kind, but that they are, universally, the result of primordial forces in nature, acting by quantity and by measure, in obedience, probably, to known mechanical laws, and as such, legitimately within the province of the mathematics; but man is unable to detect these forces, to trace their operations, to establish their quantities, or to identify their laws: and if he could, would find it infinitely impossible to bring them under the dominion of calculation. The great Geometer alone — he only is competent to the work, "who set a compass upon the face of the deep, and meted out heaven with a span."

It is sufficient for the practical man to regard the changes of matter as accomplished facts; to take them and weigh them as they are, in all the entirety of their circumstances—not over curious to analyze and apportion the previous operations, but content (if thought desirable to examine them, and, if able, so to accomplish it) to make nature herself pourtray them, graphically and mechanically, along with their results. But the mathematician is more ambitious; he aspires to walk where nature walks, to follow in her track, to tread in her footsteps, to explore the path on every side, to measure the distances and to take the bearings; but that path lies through a labyrinth of devious windings, of which she has not revealed to him the clue, and in which he is bewildered and lost; wherefore, he resolves on a direct and desperate course of his own; he vaults over the fences which hedge in, and determine the rightful way, and by flying leaps he alights at last, somewhere beyond, or short, of the point at which she has arrived. But to drop the figurative style: the mathematician is unable to trace or calculate forces in operation, except in cases such as those which the celestial mechanics afford, in which the action is simple and the agents are few. With what difficulty, and with what arduous and long continued researches, he has been able to succeed in the solution of even these problems, it would be foreign to my pur-

pose to state. He is obliged, therefore, in attempting to grapple with complicated subjects, which practical ones always are, to prepare them and render them pliable by limitations and exclusions, and by feigning convenient physical hypotheses concerning them, which are to be accepted by the uninitiated as the veritable processes which nature employs. Hence, his conclusions, though true, are true only in part, and though not containing anything that is not the truth, they do not comprise the whole truth, the truth that confronts us in the reality of things.

Approximate conclusions, certainly, are sometimes not without their value if properly appreciated as such, but it depends altogether on the nature of the subject; it may permit, perhaps, with impunity, a more or less deviation from the truth, or it may admit a correction derived from a supplementary practical process. It most commonly happens, however, that so many influential principles are disregarded as to preclude the application of corrections of this kind, and compel the practical and theoretical results to stand aloof from each other, each on their own ground. What correction, for instance, could redeem from worthlessness the mathematical theory of projectiles, and of the action of the wedge? But approximate conclusions, coming in the guise of mathematical deductions, seldom are in reality properly appreciated. They are confidently relied on by the uninformed as a sure foundation on which practice may build, and, strange as it may appear, the mathematicians themselves are liable to the same delusion. They are so wrapped up in the all-sufficiency of their science, so little conversant with the working operation of things, so devoid of practical foresight and judgment, that they do not suspect the extent of the discrepancy which will arise between their conclusions and the actual results. It was a long time before the mathem tical men who interested themselves in railroads could be induced to see how completely their theories of locomotion were upset by the trifling omission, as they deemed it to be, of atmospheric resistance. Dr. Lardner could correct Pambour's formulæ by introducing among the elements of calculation the gyration of the wheels, and at the same time state that "the action of the air was so inconsiderable that he had not taken it into consideration!"

It ought however to be mentioned that the eminently practical spirit of the age, after having imparted a peculiar character to scientific inquiries generally, is beginning to make its influence felt, even in the mathematics. Philosophy, influenced by this spirit, refuses to recognise the pretensions of the mathematics to be, whilst in her service, at least, a medium of independent research, and regards it simply as an instrument which may be made subservient to investigations conducted after the true Baconian method; but still it is a most unruly Pegasus, and if not reduced to submission by a severe and humbling discipline, will run away with his rider, after all, be he philosopher or practician. It must be remembered, too, it is only as observation, and experimental and other practical processes, form the basis of the mathematical inquiry, that useful results will be obtained. "There are no subjects," Professor Whewell candidly observes, "in which we may look more hopefully to advance in sound theoretical views, than those in which the demands of practice make men willing to experiment on an extensive scale with keenness and perseverance." It is in this light that we see the advantages that are likely to accrue, both to science and practice, from the institution of the British Association, in which the mutual co-operation of persons devoted to practical and theoretical pursuits is invited and secured. I allude particularly to the proposal for determining, by a series of experiments on a large scale, the various constants in nature, and which, among its first fruits, converted Dr. Lardner from the error of his (mathematical) ways, and realised the anticipations of the more practically-minded scientific men, as to the great influence which atmospheric resistance has upon locomotion at high velocities.*

* Practical engineers, by the way, never had a doubt of it; and yet, when the paper detailing the experiments was read in the Section of the Association at the Birmingham meeting, it was spoken of as something strangely new, the merit of the discovery of which, was solely due to science and professional *savans*, although Mr. Cubitt, the eminent engineer, (to say nothing of the statements

The *actual event* in the operations both of nature and of man is rarely simple and single in the relation of cause and effect, but is the *resultant* of opposing, conspiring, and blending influences, acting in all directions. But men in general do not take that wide survey of things which embraces all the agencies that are at work. They are apt to trace effects in a single line of action, induced thereto partly by a disinclination to be disturbed in the clearness of perception and exactness of conclusion, which in a much greater degree, or at least with much less of mental power and research, undoubtedly attends that partial contemplation of things, in single and simple aspects, which they are prone to take. This is the abounding source whence spring the one-idea-men—the men of high principles as they are pleased to phrase it—the bigots, the purists, and the ultraists, of every degree, and of every school. But the mathematician is open to this remark more than any other man. He is disposed by the idiosyncracy of his mind, as well as compelled by the impotency of his science, to seek for certainty and exactness in a unilateral course of proceeding, neither deviating to the right nor the left, nor permitting any collateral influence to turn him out of that narrow but direct and perspicuous path, which both gratifies his *penchant*, and constitutes the peremptory condition on which demonstration can be obtained. Both willingly and of necessity he foregoes one half of what may be darkly and obscurely the *real* truth, in order that, by conferring exactness and certainty on the other half, he may acquire clear and definite conceptions of absolute but *ideal*, truth. His reason is led captive by these his fond imaginations; it lies prostrate before this idol of his fancy, which, though the work of his own hands, he proclaims to be, and blindly worships, as the goddess of nature.

These are the men, and not the philosophers, as Mr. Pilbrow supposes—except only as they become mere theorists—"who so often err" in all matters appertaining to practice. The true philosopher and the genuine practical man, differ little from each other more than in this, that one works in the closet, and the other in the field; their modes of thinking are almost identical. But to the mathematician, the practical man stands directly opposed. He is not tied down to demonstration, nor enamoured of theoretical hair-breadth exactness—he can afford to take a broad and comprehensive survey of his subject, and yet be free to investigate all the agencies that are at work, for he is not concerned to arrive at the results in an *a priori* manner—he can take them as facts, and dispense with tracing them as effects—he can value and measure them by experiment, without waiting for what may never arrive, a pure scientific calculation—he can approximate to the law of the case empirically, long before it is possible, and most frequently when it is impossible, to deduce it from first principles—he can accept the law as a particular one, limited and clogged with the actual circumstances, as being sufficient for his purpose, and in truth more practically useful, without stopping in his career for an exposition of it in all its generality—and he can, in lieu of an algebraical expression of the law, make the phenomenon itself delineate mechanically its variable action, in the form of a curve, or oblige it mechanically to describe its integral amount, either as a graphical or as a numerical result—with which representation of the curve, or evoluation of the section, he can proceed onwards, as being in possession of all that is requisite or pertinent to his pursuits, leaving the mathematician behind, in despair of ever being able to find equation or integration to his purpose. So also in the way of analysis,—when the agencies, or some of them, are not clearly distinguishable, or their respective effects separable, he is content to take their conjoint influence in the ultimate issue of things, and to apportion their respective amounts by an *estimate*, founded in the exercise of a sound judgment, on the notices and hints which his sagacity prompts him to watch for and observe. Whether, however, the results be obtained by experimental analysis, more or less correct, or by this analytical estimate, more or less judicious, or

made at previous meetings of the Association by Mr. Roberts of Manchester, and others,) had expressly referred to it some three or four years before, in an examination before a Committee of the House of Commons.

by both processes jointly, he is at liberty to use them as *inductive* data on which to found anticipations, in lieu of demonstrative conclusions—framed partly, it may be, on calculation, and partly on estimate again, of other results of a similar, but unknown, because hitherto unarrived at effect, or of results of a mixed nature, arising from using other data therewith, of a different kind.

These and other practical processes conducted by judgment rather than by rule, and depending on experience, professional skill, and natural sagacity, are the distinguishing characteristics of the practical man, at once conferring on him privileges, and constituting his glory; for, however rough, or however deficient they may be in the requisitions of rigid science, they are of incalculable utility in the affairs of life, inasmuch as they comprise the sole conditions on which the untried future, whether for success or for failure, depend, and lead consequently to conclusions, which can by no other means be obtained. In this manner, then, it is, that the practical man is emboldened to venture on enterprises, novel in magnitude and in character, and astounding to the man of mathematical science, who, unable to go farther than his leading-strings will permit him, has all his views under the trammel of exactness and demonstration. Thus a slavish deference to these objects, by keeping out of sight the grounds of what is simply *rational expectation*, represses aspiration on the one hand, as much as it encourages rashness and extravagant views on the other. Mr. Pilbrow affords an example of the latter, and fully justifies the strictures I have ventured to make on mathematics and mathematicians; not, perhaps, that he himself is a mathematician, but an instance, not at all uncommon, of the baneful effect which a blind undiscriminating admiration of the science, or even an imbibing of the spirit of the science, has generally upon our modes of thinking and reasoning.*

Mr. Pilbrow expatiates on the saving of power effected by using steam expansively; but the important practical question is—to what extent can it be beneficially carried? Mr. P. adopts the mathematical view of the subject, and thus, by thinking it unnecessary to take heed of more than the defined and palpable steps towards truth, he stumbles before he reaches it. And yet, the mathematical calculation of the force of steam in expansion is not erroneous in itself, for, as Mr. Pilbrow says, "the data and principles being sound," as they here undoubtedly are, so far as they go, "the deductions of the mathematician must be sound also;" but there is simply a suppression of the truth—a suppression of those parts of the problem which he is unable to manage. The law that the force of elastic fluids is inversely as the volumes, is very true, at least within all practical ranges; the curve descriptive of its variation is simple and algebraical, and the application of the fluxionary calculation cannot be denied; but it unfortunately happens, and, sooth to say, such provoking incidents are seldom absent, that simultaneously with the expansion of the steam, a physical change takes place, which spoils all this beautiful exactness and self-satisfying certainty—turns the curve into a transcendental one—demands that the law of variation shall possess greater generality—and baffles all the powers of calculation to give the result. No wonder, therefore, that the philosophy of the subject should be sacrificed to the necessities of the calculus; the wonder is, that sensible men, as well as the public generally, should so often allow themselves to be beguiled of their good sense, and led astray by the *prestige*, which any thing mathematical, or

* As a curious instance of the influence which this science indirectly exerts, not indeed in producing baneful effects—for that is too sober a word—but in leading a writer into a display of ludicrous pedantry and solemn foolery, I give the following extract from an Assistant Poor-law Commissioner's Report, italics and all, except that the matter inclosed within brackets is what some hypercritical friend must have prevailed upon the author to erase, and which I have had the good fortune to restore.

"We appeal to every man of common sense—we go still higher—we ask, is there a philosopher or a mathematician in existence, [whether inhabiting lunar, or sublunary regions,] who can deny the *pure* truth of the two following axioms:—

1st. That in the creation [on the eighth day?] of any *sensible* poor-law system, the workhouse *must* possess a centrifugal, and not a centripetal influence, [lest chaos come again.]

2ndly. That, in any country under the sun, if $x$ denote the situation of the independent labourer, $x$ *minus* 1, and not $x$ *plus* 1, *must* be the condition of the pauper!!!"

savouring of the mathematics, carries with it. Now, what part of the whole truth of the case is it, the suppression of which has seduced Mr. Pilbrow and others to indulge such sanguine expectations, as to the much greater advantage to be derived from the expansion of steam, than what already arises in the best practice? This is the fact which is suppressed—that the temperature of the steam falls as the expansion proceeds. There is, indeed, a fall of temperature in the expansion of the permanently elastic fluids, but then the atmosphere rapidly affords the caloric which the increased capacity for heat requires, and thus, with this proviso annexed, the enunciation of the law is in that case correct. But in the case of steam, the caloric cannot be so supplied, and the elastic force declines with the temperature as well as with the density, to an extent dependent on the sources, external and internal, from which caloric may be instantly furnished to meet the demand. The available force in expansion diminishes, therefore, very rapidly under the operation of both causes; and the omission of the former is very important, when the question is, as to the *utmost* extent to which expansion can be usefully carried.

The mathematician may say that he can render the common theory more perfect. It is granted that *now*, thanks to experimental research, he can do so; but the point of complaint is, that any miserable abortion is allowed to pass, so it be concealed under a mathematical dress, and that a disposition exists, in reference to any thing not understood, to reverence it and accept it upon trust. But to what extent, and after what manner, would the mathematician proceed in the correction of the theory? It will be as well to know. Even apart from the embarrassments which the local supply of caloric creates, and granting to him the advantage arising from the convenient fiction, that in the expansion of the steam no heat is either imparted to or received from external sources, he is still unable to deal with the problem in a mathematical manner. It is true, he can combine the law of dilatability with the law of elasticity, and, with a knowledge of the temperature induced by expansion he could, by this means, and to a certain extent, easily supply the omission; but his principles will not lead him to the temperature—he has no clue to it whatever, and he must resort to tables, obtained by *practical processes*, to assist him in his necessities—tables that give the relations between the pressures and temperatures of steam at its several maximum densities; for it is supposed to be in this saturated state during the whole course of expansion. And be it observed, that he must have recourse to this expedient, not simply to find data for his co-efficients, which is a legitimately mathematical, and indeed absolutely necessary proceeding, but to supply a hiatus in his reasoning—to avail himself of an empirical, as a substitute for a mathematical relation. But after all—though by the aid of practical processess, and the exclusion of practical points, he obtains a more correct result—it still rests on the assumption that no condensation of the steam takes place during its expansion, occasioned by the sensible heat being insufficient to supply the caloric required for the increased capacity for heat. Steam, when taken of its maximum density for its temperature previous to its expansion, I believe it is generally admitted, is also of its maximum density for its temperature on the termination of the expansion; there is evidently, therefore, no *surplus* of free caloric arising out of the difference of temperatures, that would maintain more water (supposing it were present) in the state of vapour; the steam, therefore, is, throughout the expansion, on the extreme verge, at least, of condensation. But the question arises, whether, notwithstanding the fall of temperature, there may not be a *deficiency* of free caloric to keep the steam up to its greatest density, if not recruited by the latent caloric extricated from a partial condensation; for both suppositions are compatible with the observed state of the steam, on its escape from the cylinder, as to its mutual relation of temperature and density. If, in this way, condensation is produced by expansion, (for I can by no means admit that it is a settled point, one way or the other,) the mathematical theory is still a failure, notwithstanding the correction for temperature, inasmuch as it omits another important particular, affecting the density of the steam after another

manner, and in addition to that which is due to an increased volume.

Now, the practical man is not disconcerted by all these difficulties; it is his province and his privilege, whatever may be the causes, and however intricate their mutually modifying influence, to take the facts as *effects*—to take them as they are in their developement; and, what is more, to *measure* them as they are, as well in their origin as in their course, so as to arrive at a knowledge of the varying action from the commencement to the end. This he does, by making the action itself describe a curve, indicating all its variations, and revealing to him all the phenomena of steam, so far as it concerns him to know. By this method, properly studied and diversified, with the enlightening assistance to be derived from physical science, he is taught more than he could learn from any mathematical theory of the subject whatever, or however perfect the wit of man may yet be able to make it. Art ever precedes science; it must be so, from the very nature of things; it ever was, and it ever will be so. The great Watt was in nowise indebted to theoretical science; and even the physical science, which illustrated rather than assisted his operations, was created by himself.

But to return to the subject of expansion: it may be said, that though the converse is not so manageable, it would be easy to render practice very nearly coincident with theory, by making the mechanical, or rather the calorific, arrangements such, that the temperature of the steam shall be sustained during its expansion to nearly its original point; thus obviating the loss occasioned by its fall. It is true that the results of calculation, even in its simplest form, would in this case be very nearly correct, though expansion should be carried to an extreme; but here is an instance of the futility of mere mathematical considerations, and of the danger of trusting solely to them, even when they are in themselves perfectly unexceptionable. It is true, the theory is no longer to blame, as there is now no loss that it fails to indicate, and yet a real error in practice would be committed, and a positive, in lieu of a relative loss of power would be incurred, if such a suggestion were acted on; for the additional force thus acquired, could be gained only through a wasteful expenditure of means. Steam is the vehicle, but caloric is the real power, and an economical management of it consists, *in using it up*. It is just the same as in hydraulic engines;—in making available the force that exists in a stream of water, a waste is avoided in proportion to the little that is allowed to remain unappropriated; even so in regard to steam—it should as far as possible be exhausted of all its caloric; it should be allowed to expand, if practical considerations do not impose a previous limit, until its temperature is brought down to that of the condenser. But the amount of power that may be thus developed, and the extent to which the practice may be most advantageously carried, are eminently practical questions; they involve such multifarious and conflicting influences, that it is vain and delusive to give, or trust to answers, obtained in the mathematical manner; they can be given only as the results of experimental investigation, or of practice generally, and the best attention of engineers should be bestowed on the improvement of indicators and dynameters.*

Not only do arts and enterprises flourish without the aid of the mathematics, but the time is come for that science itself to derive assistance, even in the solution of its own abstract problems, from practical talent, and practical processes. This is a singular instance illustrative of the influence, I have before adverted to as being every where displayed, of the eminently practical spirit of the age. But even now, the mathematical purist will, with difficulty, tolerate the idea of a machine that shall resolve questions with the utmost facility, to do which has been, to him, a task the most arduous and profound, and that shall take up other questions for solution, which, from the incompetency of all known methods of analysis, he has been wholly unable to master — a machine that will give the numerical values of definite in-

* Neither of these kinds of instruments has met with so much attention from your correspondents as they deserve. It would be very desirable to have a description of Prony's brake dynameter, (if it be Prony's ) and of that referred to at the last meeting of the British Association, as being now employed by the Committee, appointed to report on its performances, in registering the duty, or rather the efficiency of steam-engines.

tegrals, relating to a class of functions, the analytical integration of which is beyond the scope of mathematical science. Of course only a mathematician could conceive such a machine, but to substitute a mechanical for an analytical process in the work of integration; to call in mechanical expedients to the aid of operations in *pure science*, bespeaks also in the ingenious inventor (Professor Moseley) a practically-minded man, a man of enlarged and enlightened views, in short, a philosopher.

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I cannot think that the candid reader will infer from what I have written, either on this or on other occasions, that I am insensible to the real value of the mathematics as displayed in its proper sphere; or even to the occasional and partial utility of its more mixed investigations, if used with proper reserve, and with strict subserviency to physical science. As to the derivative and technical branches of the mathematics, the rules and practical processes embodied in arithmetical, trigonometrical, logarithmical, and other useful applications, my observations, of course, do not apply at all. It is to the science, as an organ of physical and practical research, that I refer—as an instrument aspiring to detect the relations of quantities, which are too obscure, too evanescent, too numerous, or too complicated in their mutual actions, to have them determined by means so feeble, although so arrogant of pretension. It is to the opinion so generally entertained of their sufficiency in this respect, that I object—excluding and throwing into shade as they do, the less ambitious, but really more noble, because more useful and more successful methods of the philosopher and the practician. It is to the substitution, or at least to the preference given, of the deductive to the inductive modes of investigation, that I am opposed; prematurely employed as they are, on subjects which philosophy has not yet prepared for the application, or which, from the infinity of their nature, will never, with any propriety, be susceptible of such a procedure. It is the continued adherence to the ancient heresy that I denounce, which extirpated by Bacon from the physical sciences, has found a resting place among the mathematicians, who think it a sufficient satisfaction to their consciences if they do but transfer the old *à priori* method from occult qualities to tangible quantities; although, putting impotency against ignorance, the one is as insufficient and unorthodox as the other, on which to found a creed of scientific verities. It is therefore, in fine, not against the legitimate use of the science, but against its abuse, that I protest; and against that supremacy which is accorded to it; not merely by the uninitiated, but by those who have made their estimate of its value under the influence of College routine, and from the all-engrossing importance which is assigned to it in examples of mere scholastic exercise, instead of taking it from experienced exemplifications of its utility, in the actual and every-day demands of practice. It is the self-delusion, induced by these early and powerful influences, that I wish to expose; to point out the errors, both in straitness and extravagancy of conception, to which it necessarily leads; and at the same time to exalt the merits of the less assuming practical man, even in an intellectual point of view, to a higher position than that in which it is customary to regard him, I am, Sir, Yours, &c.,

BENJ. CHEVERTON.

P.S. I am greatly pleased to find that your correspondent S., adopts those sober and practical views in reference to the expansion of steam, which from the general tenor of his communications, and indeed from express reservations made by him, I expected he would take. My own profession is too far removed from such pursuits, to make my opinion as to the extent to which it may be usefully carried, worth recording—not so, however, probably with S., or with many of your correspondents, who can speak from knowledge and experience. I hope Mr. Pilbrow will not be alarmed at the diffuseness of my remarks, of which, in truth, he is not so much the subject as the occasion. It arises from a habit that I have, and whether it be good or bad, it has, I hope, this effect at least; to divest controversy of its mere polemical character, and make it the vehicle for observations elucidatory of the subject generally, and calculated to elicit useful information from all quarters. Thus your correspondence, Sir, becomes assimilated to those interesting and valuable discussions which take place in our several scientific institutions after the reading of a paper, but with this difference, that the thoughts

communicated are more carefully weighed and matured. I will, however, be more concise in my next. B.C.

THE SYMINGTON SYSTEM OF CONDENSATION.

We have always thought well of this system of condensation, and often wondered much that it should have been so slow in finding its way into general use. Disputes have been raised as to its originality, (the common fate of all notable inventions,) but none, that we are aware of, as to its superior efficacy in keeping boilers clean, and preventing that waste of fuel which is the inseparable attendant of continual incrustation. A friend of ours, who was lately at Hull, saw a steam-tug on the Humber, (the muddiest river, perhaps, in the kingdom,) with Mr. Symington's condensing pipes attached to it; and his account of its performances, (on the accuracy of which account we have every reason to place the most implicit reliance,) is such as should set all doubts and questions on the subject at rest. The vessel is called "The Dispatch," the property of a Mr. Fletcher; and, since it was provided with the Symington apparatus, it has been in constant work *for more than two years*. Mr. Fletcher himself assured our informant, that his boilers were now as clean as when first put into the boat—that his saving in fuel during the time had been from one-fourth to one-third—and that all the while, such a thing as stoppage from want of steam, or priming of the engine, (called by Mr. F. "foamenting,") had been unknown. The apparatus by which these important advantages are obtained consists of little more than a number of copper pipes placed externally to the vessel, any where below the line of floatation; and may be added to any ordinary steam-engine, without necessarily involving any change whatever in its construction.

ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

*** *Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for that purpose.*

PIERRE JOURNET, OF DEAN-STREET, SOHO, ENGINEER, *for improvements in fire-escapes, which improvements are applicable to other useful purposes.*—Enrolment Office, November 19, 1841.

The first of these improvements consists in enclosing a fire-escape, of a peculiar construction, in that part of the wall which lies between the window-cill and the floor of a room. The brickwork being removed, this space is enclosed by two wooden or metal flaps, the outer of which may be painted to resemble the wall. Within the recess thus formed is stowed away a folded platform, having a rope attached at each of the four corners that passes through the ends of four horizontal rails which surround and enclose the platform. These ropes are led through two pulley blocks, and connected with a small crane, which moves vertically upon a rod fixed to one side of the window.

In case of fire there is a handle placed at the side of the window, on turning of which the enclosing flaps fly open and the crane is raised to the top of the window by the release of a counterpoise weight, and held there by two small flaps; at the same time a couple of ropes fall down into the street, by one of which the platform is raised or lowered, while the other serves to guide it in its motion. The parties in danger may then (to the number of four) step into the platform and lower themselves by the rope and pullies, or they may be lowered and guided by the police, or other persons in the street.

A second contrivance consists of a travelling balcony, running upon a railway extending along in front of a row of houses. Into this balcony the inhabitants of a burning house may enter, and escape to some friendly roof more remote from the threatened danger.

The claim is, 1. To the mode of combining apparatus whereby a crane, &c., are contained in a recess under the window ready for use in cases of fire, and also as applied to cleaning windows.

2. To the mode of applying a movable balcony to houses, as described.

We strongly suspect the inventor (M. Ador) and the patentee have grievously overrated both *the value* of these inventions, which differ in nothing from a hundred others suggested by British ingenuity, and also the *probability of their adoption* by the "nation of shopkeepers," the great majority of whom, it is too well known, treat all these matters with proverbial apathy and indifference. Should a prudent man be desirous of providing for the safety of his family and dependents, the simple but highly efficient domestic fire-escape of Mr. Merryweather, described at p. 454 of our 33rd volume, would quite as effectually answer his purpose as either of the foregoing patented contrivances, at an expense of fewer shillings than they would cost pounds!

JOHN CARR, JUN., OF PADDINGTON, ENGINEER, *for improvements in apparatus for retarding and stopping railway carriages.*—Enrolment Office, November 20, 1841.

A horizontal rod extends the whole length of the carriages, having a slot at one end, and also a slot before and behind each of the wheels of the carriage; the latter receive the

ends of straight arms which project upwards from short horizontal axes, supported by brackets attached to the under side of the carriage frame. Each of these axes also carry curved levers with projecting flanches working in guide-brackets on the backs of the breaks, the pressure of which against the wheels is resisted by stays attached to the axes. At the end of the carriage a vertical rod is placed, having a handle at top, and a screw at bottom, which takes into a nut at the end of a lever; on the axis of this lever there is a straight arm which enters the slot at the end of the horizontal rod before described. By turning the handle, therefore, the lever is raised or depressed, which, moving the horizontal rod backward or forward, acts on the curved levers, and applies or withdraws the breaks.

Charles Phillips, of Chipping Norton, Oxfordshire, Engineer, *for improvements in reaping, and cutting vegetable substances as food for cattle.*—Enrolment Office, November 20, 1841.

The improvements in reaping consist in the employment of a machine mounted on two running wheels, to one of which a cog-wheel is attached, which gives motion to the machinery. The machine is pushed forward by manual labour applied to a couple of long handles, from which, behind the cutting apparatus, is suspended a receptacle into which the cut corn is thrown by an endless web. In front of the machine two horizontal plates are fixed, one above the other, which carry the vertical spindles of a series of horizontal circular cutters. The points of these plates project forward, and receive the corn in the spaces between them, where they are brought into contact with the cutters. The points of the lower plate which project the furthest, are connected with those of the upper plate by wires, which guide the corn to the cutters, and, after it is cut, on to the endless web.

There are two triangular projections, formed of rods, in front of the machine, which guide the leaning corn into its proper course, at the same time that a revolving gatherer, placed above, gives it such an inclination that, after it is cut, it duly falls on the endless web, by which it is carried and thrown into the receptacle.

The improvements in cutting vegetable substances as food for cattle, consists of an improved chaff-cutter for cutting hay, straw, &c., the trough and propelling rollers of which are like those commonly employed, but at one side of the mouth of the trough there is a stationary toothed wheel, through the centre of which the fly-wheel axle passes. A circular cutter is mounted on a spindle attached to the fly-wheel, and has a small pinion affixed to it which takes into the fixed toothed wheel before described, so that as the fly-wheel revolves the cutter is carried across the mouth of the trough, and at the same time, rotating on its own centre by the action of the toothed wheel on its pinion, a long run of keen cutting edge is obtained, and the protruding portion of the hay, &c., cut off.

In another machine for this purpose, a long straight cutter is bolted to an iron bar, which is jointed to a couple of reciprocating levers; a reciprocating movement being given to the iron bar by a connecting rod and crank, the cutter is drawn across the mouth of the trough, and the protruding portion of the hay, &c., cut off by its semi-sawing motion.

Another machine for cutting turnips, mangel wurzel, &c., is also described.

George Hulme, of St. John-street, West Smithfield, Brass and Cock Founder, *for improvements in water-closets.* Rolls' Chapel Office, November 27, 1841.

These improvements relate to a method of supplying a flow of water to the basins of water-closets generally.

On the side of the basin is placed a pump-barrel, from which a pipe, attached near the bottom, proceeds up to the cistern or reservoir; and a similar pipe, situated near to the top, leads to the basin. A bucket which works within the barrel is furnished with a valve opening upwards, so as to allow water to pass from the under to the upper side of the barrel. A second valve is suspended some distance below the bucket, by a loose joint, so as to be brought up against a valve-seat fixed below the range of the bucket. The bucket is attached to a piston-rod, which works through a stuffing-box in the top of the barrel, and is connected by a joint-piece with the short arm of a long lever, which works in a fulcrum affixed to the barrel. At the end of the lever there is a handle, on raising of which the bucket is depressed, and both the valves opened, which allows a free passage for the flow of water from the reservoir to supply the upper side of the bucket, and to pass through the pipe to the basin of the closet. The quantity of water thus admitted into the basin is regulated by a cock in the water passage, which can be turned so as to afford an increased or diminished passage. The water continues to flow until the lever is permitted to fall by the action of a counterpoise weight, when the suspended valve is drawn up against its seat, and stops the passage.

The claim is, to the mode hereinbefore particularly described, of keeping a valve open for any required length of time, for the supply of water to the basins of water-closets.

John Winterborn, of Clarence-place, Hackney-road, Surgeon, *for improvements in machinery to facilitate the removal of persons and property from premises, in*

*case of fire, which improvements are applicable to raising and lowering weights generally, to assist servants in cleaning windows, and as a substitute for scaffolding.*—Enrolment Office, November 22, 1841.

The *fire-escape* referred to in the above wordy title consists of a stout wooden tube, within which there is a rod or pole. Two small pulleys are placed at the top of the tube, on opposite sides, over one of which one end of a rope is carried down within the tube and round a pulley at the lower part of the pole, from whence it rises up, and passes over the second pulley at the top of the tube. On pulling the ends of this rope the pole rises within the tube until it reaches the required elevation. At the top of the pole there is a hole, or socket, into which the stem of an iron hook is fitted. This hook has two curved arms, one of which grasps the inside of a window-cill, &c., while the other supports a fall and tackle, by which a cradle and platform (similar to that of M. Journet, described at p. 446) is raised or lowered.

When used as a scaffold a number of hooks are employed, one being affixed to each window, and carrying a frame on which planks are laid to form the scaffold.

Such of our readers as are familiar with the history of fire-escapes for the last ten or twelve years will recognise in the above apparatus a *very old friend* with scarcely *a new face.*

JOHN WHITEHOUSE, OF DEPTFORD, KENT, ENGINEER, *for an improved method of making boilers to be used in marine steam-engines.* Enrolment Office, November 25, 1841.

These improvements in marine steam-boilers, for marine steam-engines, consist in forming them in two compartments, one above the other; both of which compartments communicate with a steam chest or chamber, in which the steam is received at the same time. This steam chest or chamber is so arranged and provided with valves, as to be easily separated from either of the two compartments, when it is required to put one of them out of work. There are two sets of furnaces—one set of three for each of the compartments, having their distinct and separate flues; the two compartments being independent of each other in respect to the water spaces. The smoke and other products of combustion from each set of furnaces do not come together till both have arrived at an elevated point in the funnel or chimney. There is a platform in front, for the fireman to stand upon, while tending the upper set of furnaces. The advantages claimed for this arrangement are, a great saving of space in large steam-vessels.

JOSEPH BETTERIDGE, OF BIRMINGHAM, WOOD-TURNER, *for an improved method of manufacturing papier-maché, pearl, china, ivory, horn, wood, and compositions, into pillars and stands for table or other lamps, and other articles of domestic furniture.* Enrolment Office, November 27, 1841.

The patentee takes well-seasoned birch, elder, or other wood, and reduces it in a common lathe to a rough representation of the intended design, and drills a hole through its centre; it is then placed in a japanner's stove, for from seven to ten days, according to the nature of the wood employed, the most porous requiring the longest time: the temperature at first is 120°, which is gradually raised to 250°. The article is then taken out of the stove, and finished off on the lathe; being coated with papier-maché, or japanned and ornamented with pearl, ivory, &c., by inlaying. The stand may be formed of wood similarly operated upon, or it is preferred to be of metal, to give stability to the pillar. Wood thus treated is said to be exempt from atmospheric influences, and therefore not liable to expansion or contraction by heat or damp. Cornices, poles, rings, &c., are also formed of wood by the foregoing process.

The claim is to the method of manufacturing pillars and stands for lamps, by applying stove-dried wood as hereinbefore described; either ornamented or not by the application of papier-maché, pearl, china, ivory, horn, or composition.

JAMES SHANKS, OF SAINT HELEN'S, LANCASHIRE, CHEMIST, *for improvements in the manufacture of carbonate of soda.*—Enrolment Office, November 27, 1841.

In one method described the patentee takes the masses of black ash, or impure carbonate of soda, as prepared by the manufacturers, and breaks them into pieces of about an inch cube, which are placed in layers of about 3 or 4 inches deep in a close vessel of stone or iron, called a carbonator, and moistened with water. The carbonator is furnished at opposite sides with entrance and exit pipes, through which a stream of carbonic acid gas is passed till the whole of the soda and lime is carbonated.

According to a second method a carbonator of iron or stone, not less than 10 feet deep, and containing 16 feet for each ton of soda-ash to be operated upon, and 6 cubic feet for each ton of crystals to be made per diem; has an arch of open brickwork thrown across the bottom, the remaining space being filled with small pebbles. A stream of carbonic acid gas being led into the arch, the black ash is made into a lye, which being poured into the top of the carbonator, trickles through the interstices of the pebbles where it comes in contact with the gas, and is carbonated. The carbonic acid gas is preferred to be made by treating limestone with muriatic acid.

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TAYLOR'S IMPROVEMENTS IN PROPELLING.

Fig. 1.

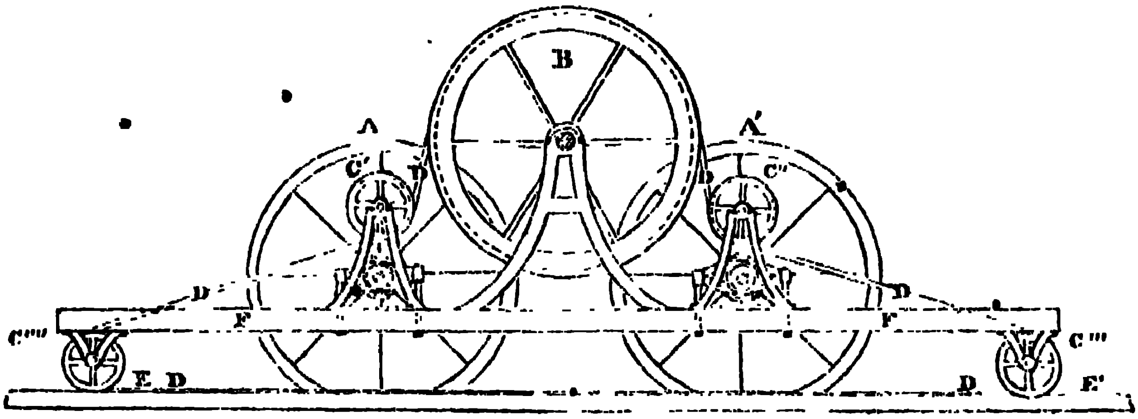
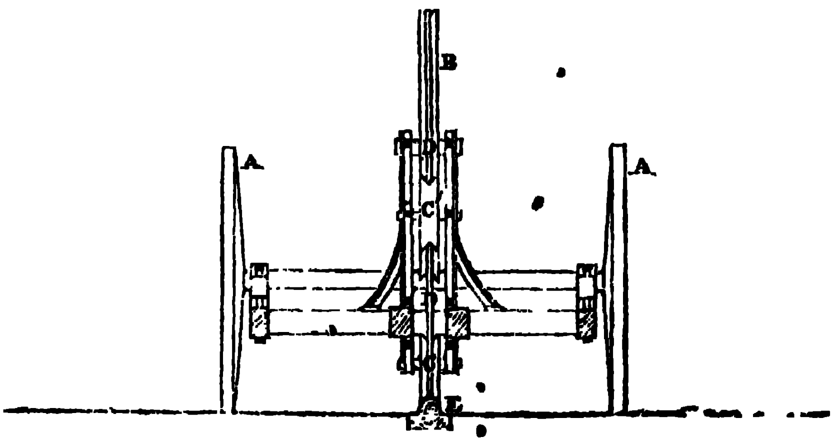



Fig. 2.



## TAYLOR'S IMPROVEMENTS IN PROPELLING.

In almost all scientific discoveries the progress has been made a step at a time—there has been no arriving, *per saltum*, at the acmé of mechanical excellence and perfect arrangement. The railway system, the first dim outlines of which appear to have been traced about twenty-five years ago, but which can scarcely be said to have been at all understood previously to the opening of the Liverpool and Manchester Railway, seems to form an exception to this general rule of the gradual advance of scientific improvements. The London and Birmingham, the Grand Junction, and other lines, were designed and laid down with a haste that regarded the prospect of a speedy return for outlay, rather than a calm and scientific investigation into the best means of conveying the Great Northern traffic. The Great Western evinced more originality in its design, but it has rather been a series of bold experiments, some successful, and others the reverse, than the result of scientific and practical experience. Such experience, indeed, it was impossible to gain, except from the actual construction and working of locomotive lines, and the eagerness with which speculators of all classes rushed into the market when any railway scheme was announced, gave neither time nor inducements for professional men to investigate the matter with the circumspection and calmness demanded by a question so important as the internal traffic of a great country.

We now begin to feel the results. We find that the public traffic cannot be conveyed over a road that cost six millions of money, at the same charge that would amply pay, had the cost of construction been a third of that sum. We find that certain means of ensuring mechanical facilities have been attained at so enormous a cost as entirely to prohibit the extension of those facilities to less favoured portions of the country, while at the same time it may be questioned whether those means are the best suited for the end proposed to be attained.

The outlay incurred to maintain the favourable gradients of the London and Birmingham line, for instance, has been very large; and yet the London and Birmingham is not superior in the average speed or economy of its trains to other lines of steeper inclinations. On the Great Western, the slight amount of the utmost deviation from a level, and the steadiness afforded by the broad gauge, have been succeeded by a speed superior to other lines. But here, again, the outlay to secure these gradients has been enormous. In all railways the cost of locomotive power (to say nothing of the expense of maintaining works of such magnitude) has been hitherto so great as to evince that the advantages of first class gradients have been greatly overrated, or, are not as yet fully developed. Mr. Bury's evidence before the Railway Committee supports this statement.

Large cost in construction, and large expense in conducting traffic, are the commercial disadvantages of railways. They are disadvantages which operate on the pockets of the proprietors—on the convenience of the travelling public—on the development of increased traffic—and on every scheme for the extension of the railway system. But these commercial disadvantages are dependent on the mechanical imperfections of the railway system. If means can be devised by which the power now expended and wasted in the locomotive department, could be made to produce a direct and useful effect on the transits, we should at once have the means of conveying the public at as little *annual* cost over the natural surface of the country, as is now expected after the outlay of millions, spent in the first instance in the construction of embankments, excavations, viaducts, and tunnels.

Gravity and friction are the two grand powers, or more accurately speaking, the properties of matter that resist and tend to destroy motive power. It is to diminish the effect of the latter of these resistances that the efforts of the railway engineer have been so successfully directed. The friction of surface resistance on the common roads naturally varies according to the quality of the road metalling and its state of repair; the variations on the Holyhead road from London to Shrewsbury; ac-

cording to Mr. M'Neil's experiments, being from 40·4 lbs. to 118·6 lbs. per ton, and the average value 76 lb. per ton. On the rail, on the other hand, the friction amounted, according to Mr. Nicholas Wood's early experiments, to 11·2 lbs. per ton; it is stated by M. de Pambour at 7 lbs. per ton; by Dr. Lardner at 6 lbs. per ton, and an allowance of 8 lbs., or at the utmost 9 lbs. per ton is the highest at present made for this resistance on railways, and with carriages of modern construction.

A diminution to the amount of ninety per cent. in one of the principal resistances to motive power naturally involves an equivalent saving in power or in time, or in the other two together, on a comparison of a locomotive railway with the best constructed and regulated of ordinary roads—an economy of which, however, owing to the system hitherto adopted, full advantage has not yet been taken. The obstacle has been in the mode of communicating the motive power—of transferring the force from the pistons of the steam-engine to the fulcrum of its resistance—the Earth. In road vehicles, and on those railways where horse power is employed, the mechanical arrangements are far superior to that of the present locomotive. The horse having a fair purchase on the ground applies his force to the traction of a carriage; and as the friction of that carriage is diminished without in any way diminishing the motive power of the horse, the advantage of that economy may be taken fully in regard to power, though not, except to a limited extent, in point of speed.

The locomotive engine, on the other hand, depends for its motive force, solely on the adhesion between the rail and the driving wheel of the engine, and as the friction of the bearing wheels is diminished by rendering more smooth and slippery the surface of the rail, so is the adhesion of the driving wheel diminished, and the steam power of the engine rendered less available. Thus when owing to the state of the atmosphere or other causes, the rails have become so slippery as to offer the least possible resistance to the transit of a train, the line is so far from being in the best working order that the driving wheels of the locomotive may be seen to spin round and round, impotent to move the engine and its train a single foot in advance. Thus contrary qualifications are required from the same portion of the machinery—it is necessary for the rail to present as little resistance as possible to the passage of carriages, and at the same time to offer a sufficient adhesion for the driving wheels of the engine.

But this objection, while it exists in the very nature of railways as at present constructed and worked, is of little practical moment on a level surface. The adhesive power, in such cases, is sufficient to enable the engine to draw with comparative ease a load duly proportioned to the power exerted. It is when the force of gravity comes into more direct operation, when the moving power is required not only to overcome friction but to lift weights, that the ill effects of the adhesive system begin to be felt. It is to obviate this difficulty that such immense sums have been expended to procure favourable gradients, to depart as little as possible from the actual level, to escape from the unpleasant fact, that in railway locomotion that which is lost in time cannot always be saved in power. Mr. Booth, no mean authority in railway matters, has very clearly illustrated this startling difficulty in his "Account of the Liverpool and Manchester Railway."

"For instance," says that gentleman, "7 tons on an inclined plane rising one in a hundred, is a proportionate load to 30 tons on a level, at fifteen miles per hour, the weight of the engine being 4½ tons, as explained hereafter. But if it be attempted to take 30 tons up the plane, by going proportionably *slower*, the *power* of the engine might do this, but the adhesion of the wheels would be insufficient, and they would turn round, while the engine stood still, because 30 tons on the inclined plane = 99 tons on a level, and we have supposed the adhesion to be equal to 40 tons on a level. It follows, therefore, either that the engine must be worked *below* the adhesiveness of the wheels on the level, or you cannot increase the proportionate load by diminishing the speed on the inclined plane."—Pp. 79, 80.

Mr. Parkes, in his valuable paper on steam-boilers and engines, published by the Institution of Civil Engineers, remarks, (p. 101,) that "no power of steam would impart progressive motion to the engine, if loaded beyond the

force of its adhesion to the rails; that force is, therefore, the dynamic limit; the supply of steam is a mere practical condition of the boiler." Thus the *North Star* engine, which, according to the experiments of Mr. Nicholas Wood, took a gross load of 194·7 tons at a mean speed of 18·63 miles per hour, would be unable to *move*, if the rails were in an unfavourable state, a gross load of 50 tons on the very moderate inclination of one in a hundred. Nor, with slippery rails, would it be able to crawl up, without any load, an incline of one in thirty—a rise by no means considerable on a turnpike road. The disadvantage of depending on adhesive force for the communication of motive power seems to need no further illustration.

As we have hitherto considered the defective mode of the application of the power when brought to the periphery of the driving-wheel, let us now look at the loss sustained in its transmission to the periphery from the piston. In ordinary roads, if a heavily loaded wagon has become set fast in the mud, it is not uncommon to see the trace attached to the tire of one of the wheels, that, by means of exerting the power of the horse on the leverage thus afforded by the diameter of the wheel, a greater purchase may be gained than is afforded by a dead pull at the shafts. But if we conceive the case to be reversed, and that, instead of the horse's power being so exerted, the leverage of the wheel shall aid the pull, or that the carriage, being pulled in advance, has only to roll forward on the bearing wheels adapted for this purpose, it should be employed to turn round an axle, on the ends of which were fixed wheels whose motion, communicated from this axle, was to move the carriage—in this case, is it not evident how it would be applied to the power of the animal? Yet this is precisely the case with the locomotive steam-engine. The motion of the piston being communicated by cranks to the main axle, has to contend with the torsion of the axle—the spring in the spokes of the wheel, and the opposing leverage of the wheel itself, (causes of the loss of so much power as to lead Mr. Brunel to abandon the ten-feet driving wheels, which he had introduced on the Great Western;) to arrive at the point of useful effect, which, after all, is then solely dependant upon the adhesiveness of the rail.

Attention to these, and similar details, will go far to explain the prodigal consumption of steam that has hitherto marked the locomotive engine, and raised the cost of locomotive power so far above the estimates of a few years ago. To obviate these manifest evils, as well as to economise the use and production of steam, is the aim of the improvements patented by Mr. William Hannis Taylor,* the following description of which is taken from his specification recently enrolled.

Figs. 1 and 2 on our front page represent so much of a locomotive engine, for either a railway or an ordinary road, as is requisite to exhibit the application of these improvements. A A′ are the wheels of the carriage, and F F the frame-work; B a main driving wheel, or drum, to which motion may be communicated by means of a steam-engine, by manual labour, or by any other adequate power; C′ C″ C‴ C⁗ guide-pulleys for D D, a messenger or propelling rope; E E′ is a grooved rail, fixed firmly to the earth in the centre of the track intended to be traversed by the locomotive, on or a few inches above the level of the surface. Into this groove the messenger D is pressed firmly by means of the guiding-pulleys C‴ and C⁗, in the front and rear of the locomotive. The bearing-wheels A A may be either fixed on a revolving axle, or not, and may either have flanges, or not, according as the machine may be intended to run on a railway, or on a plain surface. The drum B has a grooved circumference, and the messenger, or endless propelling-rope, is firmly pressed into this groove by means of the pulleys C′ and C″. In order to propel the carriage, motion is given to the drum, or driving-wheel B, by means of a steam-engine fixed on the frame F F, or by any other suitable motive power. The drum revolving in the direction A′ B A, hauls in the messenger from behind the carriage, and as the under part of the messenger is at the same time pressed into the groove

* Patent dated June 5, 1841; specification enrolled December 4, 1841.

of the centre rail E E′ the carriage is consequently propelled forward; the messenger, as it is delivered from the drum B, passing under the guide-pulley C″, and over the guide-pulley C‴, and being continually pressed down by the pulley C‴ into the guide-rail E E′ in advance of the carriage. By means of the hold thus obtained by the messenger D D on the grooved guide-rail E E′, for the distance C⁗ C‴, the whole of the motive power made use of may be effectively applied to the propulsion of the machine. In order to propel a boat or other vessel through water, Mr. T. proposes to make use of a similar arrangement, but with the substitution of a chain for the messenger-rope D. The drum B may in this case be toothed, or hollowed, to fit the links of the messenger chains, and the centre rail may be dispensed with, by making the messenger chain of sufficient length to rest on the bottom of the water, for the length of the boat, or thereabouts.

C.

## PHILOSOPHY OF STEAM.

Sir,—Notwithstanding there is nothing considered true, which is not warranted by the standard of Newtonian Philosophy, the subscriber venturously undertakes to show, anti-Newtonianly, wherein consists the physical power which gives force and elasticity to steam: a discovery which the Newtonian Philosophy has never made, nor can ever make.

Throughout the whole of physical nature there is but one source of power or physical force, which is, the PRESSURE OF THE MEDIUM OF SPACE.

The elementary atoms of matter being inert, all bodies formed of them are equally inert; therefore the bodies of the planets cannot perform self-motion. Each must be impulsively moved by something foreign to the planet; and impulse must be as constant as motion, because effect is always the measure and equal of cause; that is, cause cannot be less than effect. In other words, cause and effect are always equal. The duration of motion, implies equal duration of impulse.

Nothing short of a medium filling planetary space, can keep the planets impulsively and unceasingly in motion. The medium of space pervades our atmosphere and all terrestrial bodies, in consequence of the spherical shape being that of all the atoms of matter.

All the atomic substance of nature, being not only inert, but unalterable in both substance and essence, they—the elementary atoms of matter and bodies—can suffer no possible change but of a local nature or change of place, which is motion.

There being no effect producible on the atoms of matter, (therefore, on those of bodies,) but motion, for which impulsive pressure is the only analogous cause, and as that which can move planets can move atoms, there needs but one universal cause of motion in the system. Hence to the pressure of the medium of space is all motion, great and small, strong and weak referable. And from its different general services, the medium of space admits of the designations, "medium of pressure," "medium of force," "medium of motion," "medium of space," each according to the immediate performance of that common medium.

The earth being moved by and through the medium of space, may be said to be soaked with it, as with water a submerged sponge is soaked.

The medium of space pervades the interstices of the densest bodies, and is more or less one of the constituent elements of all manner of bodies.

As the water in a submerged sponge is continuous with the surrounding water, so is the portion of the medium of space within a body continuous with the like medium in space generally, by which every atom in the constitution of a body is under the general pressure internally as well as externally; which is productive of expansion, or contraction of the body, according as promoting circumstances render the internal or external pressure on the atoms of the body the greater.

Heat is no agent in steam making. The mechanical system of nature includes nothing whatever of material heat. Heat is a sensation, a state of feeling, or of consciousness—nothing of which is hot; yet from such mere sensible effects, we infer that their remote cause, the fire, must be hot. The fire promotes pain and torture without possessing either; and the sensation, sound,

is promoted by that which possesses nothing similar to the sensation. Therefore, these and all other sensations inform us, only, of what bodies have not and do not belong to matter.

Water includes some portion of the medium of space. On the fire it is constantly acquiring additional increments of the same medium; which, from being under the external general pressure, expand the water and produce ebullition.

When the medium of space is in sufficient excess, it throws out elementary matter from the water; which matter may be considered nascent steam, from not including all the elements of steam.

Steam consists of the thrown-out elementary matter, and a vast influx of the medium of space, which accounts for the volume of steam being many hundred times greater than that of the water expanded from the boiler; without the medium of space steam is but a transparent air, without force or elasticity, equally as the flame of a candle.

Steam is thuswise formed—premising that all bodies suffer loss by fire; the contrary is a general mistake. Wood, coal, candles, paper, the ends of iron pokers, bars of grates, furnace bars, the air, its oxygen, all suffer loss by fire. The water in the boiler suffers loss of elementary matter in the direction of the fire. This loss is replaced by the influent medium of space, which first expands the water, then throws off the elementary matter, which becomes steam as the medium of space, in great excess, flows into it. And as the whole of the included medium of space is continuous with the medium in space generally, so it is, the pressure of the general medium of space which constitutes the force and elasticity of steam.

The general pressure is the power of steam. The medium of space being removable and returnable through the pores of the cylinder, as the steam meets resistance or may be compressed for a while, is the cause of the phenomenon *elasticity*, of air as well as steam. The atoms of steam are hard and inelastic.

The elementary matter which water loses downwards when in contact with fire, is collected visibly on the sides and bottoms of bright vessels and of glass retorts, and appears as small air bubbles or beads of air, which no disturbing force can make ascend while the water is on the fire; eventually they are forced through the boiler towards the fire. This elementary matter, and that which is thrown over to make steam, together, include all the elements of the portion of water lessened in the boiler. Therefore that portion of water underwent decomposition, and differently than by means of art.

The force of steam is, as the quantity of the medium space included in the forced over elementary matter; which is, as the quantity of elementary matter forced downwards, which is as the intensity and continued agency of fire.

The depressed elementary matter being highly rare, admits of being named electric matter. Could this matter be extracted by electric or galvanic agency ebullition would follow, water be made (apparently) hot, and steam be formed without the agency or expense of fire.

As steam is formed by de-electrizing water by the agency of fire, so to increase the power of steam, the steam itself should be further de-electrized, by passing it through ignited tubes, into the also ignited cylinder.

The steam from the boiler at present acquires elementary matter from every thing it touches or passes through, which displaces proportionally from it the medium of force; so that in the boiler it cannot be too much de-electrized: to meet this casuality were there nothing hazardous, the boiler should be bricked over; and were it convenient, the cylinder should be within the boiler. On these principles it seems that, steam must lose force on first using, and become unfit for using a second time, unless further de-electrized by ignited tubes.

The steam in the boiler and shut off from the cylinder, contains more of the medium of force than the immediately working steam, which is owing to its being confined in the boiler and being nearer the fire than the cylinder. This excess of the medium of force subsides almost instantaneously, through the pores of the cylinder when the steam is let flow from the boiler otherwise than suddenly.

When the confined steam is permitted to rush into the cylinder suddenly, the excess of the medium of force it contains causes the top of the cylinder to

lly out gives the piston an instantaneous impulse, much greater than the force of the working steam after this impulse. On these phenomena, as mentioned in a late *Mechanics' Magazine*, your correspondent, Mr. Parkes, remarks, that "this extra force, or percussion stroke, has been given to the piston by a force which is perfectly distinct from the steam's elastic force"—a remark which, for shrewdness of observation and sagacity of judgment, cannot be exceeded in the history of science.

Thus, in the briefest manner, by avoiding all immediate reference to first principles, and indispensable contingent circumstances, which would make the theory more explicit, but at the hazard of being less investigated, from being more lengthy, has the philosophy of steam been stated. The philosopher and chemist will denounce the whole as being a mere mechanical procedure; but the engineer should have strongly in mind, that all procedure is by natural means—that nature knows nothing but mechanical means and mechanical procedure; and hence, that what is not mechanical, in every respect, is neither natural nor true, and but fiction of the philosopher or chemist. The task of the scientific critic is, to prove the falsity of any one of the foregoing propositions. I am most willing to afford every required explanation.

T. H. PASLEY.

Jersey, Nov. 20, 1841.

## ON THE CAUSES OF INJURY TO STEAM BOILERS. BY C. W. WILLIAMS, ESQ.

SIR,—In my last paper (page 437) I enumerated the usually alleged sources of injury to boilers, and have now to consider that of incrustation from the precipitation, during the process of evaporation, of the earthy matters held by the water in a state of solution or suspension, consisting commonly of carbonate or sulphate of lime. It is said by many of the best authorities among practical men, that this produces injury, from the circumstance of its sudden breaking up and dislodgement in large portions, by which the water obtains instant access to the overheated places beneath it—that a sudden generation of steam, of a highly elastic force, is necessarily the consequence—and that bulging of the plate, rupture, or explosion, may therefore ensue. These allegations and deductions appear to me not only inconclusive, but unsupported by facts, and for the following reasons.

That incrustation does attach itself to the plates of boilers, and even adheres so firmly as to require the force of a hammer and chisel to dislodge it, is unquestionable; but, that any of the above alleged results should follow, will, on further inquiry, appear to be unsustainable, and even impossible. It has been assumed that the iron plate beneath this incrustation, and particularly at the parts exposed to the greatest heat of the furnace, becomes overheated and even red-hot, by reason of the non-conducting character of such incrustation. It is so stated by many, who even assert that they have witnessed the fact. That they may have seen an overheated and even red-hot plate, I will not dispute; but that it has been caused by such incrustation, I must take leave to deny. Struck with the fact, that several of our marine boilers, which, to the last, continued excellent generators of steam, although their flues and general interior were loaded with incrustation, and in which the circumstance of an overheated or bulged plate had never occurred, I began to doubt the alleged theory of this non-conducting faculty, or of its being the cause of that sudden development of steam from which danger was to be apprehended. Finding, also, that this incrustation had a specific gravity beyond that of marble, and was so close in its texture and grain as to admit of a high polish, my doubts became stronger, and I determined to put the matter to the test of the severest experiment. I had several cylindrical tin vessels made, the bottoms of which were formed of pieces of this so-called non-conducting *incrustation*, of from one-eighth to five-eighths in thickness. I also constructed similar vessels with *iron* plate bottoms, and of corresponding thicknesses.

These vessels, being filled with water, were successively placed over the intense concentrated heat of a powerful Argand gas-burner, so arranged that no heat could reach the water except through the bottoms. The result was, that the supposed fact, and the ingenious superstructure of overheating, expanding, sudden generation of steam, rupture, and explosion, were at once proved to be an unsup-

ported and untenable theory; and the error of this non-conducting hypothesis became apparent.

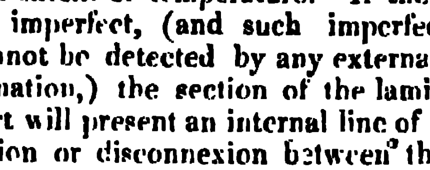
With respect to the ratio of conducting power of the iron or incrustation, I can only say that the thermometer placed in the water in those vessels, indicated, both in the progression towards the boiling point, and subsequent evaporation, so little difference, that until more accurate experiments shall be made, I am unable to say which is the better conductor, *iron* or *incrustation.* At all events, nothing can be more decidedly proved, than that no possible injury to the iron plate of boilers could arise from the interposition of this incrustation between the water and the iron plate; and that the inferences drawn from the supposed fact of non-conduction in the incrustation, cannot any longer be legitimately maintained.

To establish the fact further of the excellent conducting power of the crystallized incrustation, and that it was not itself affected by the heat of which it was the mere carrier, I ascertained that while the transmission of heat was at the maximum, and the boiling violent, the bottom of the vessel, namely, the incrustation, was so cool, that I could even press my finger against it without inconvenience. This latter illustration was made in presence of Mr. Parkes, who himself proved the fact of the absence of any heat in the incrustation, beyond what would have been the case had it been made of iron of equal thickness. In fact it was only when the direction of the heat was reversed, and allowed to *pass from* the water, downwards, and through the incrustation bottom, that it became too hot for the finger to bear.

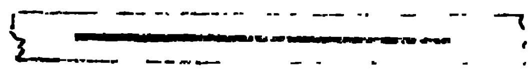
It will now be asked, to what cause, then, are we to attribute the well established fact of the overheating of boiler plates, and their consequent deterioration and bulging, particularly in the parts most exposed to the radiant heat of the furnace? I would here mention an important circumstance, which I have not hitherto seen noted, but which bears strongly and directly on the point before us, namely, that although it is a well known fact that in *land engines*, boiler plates are frequently bulged and ruptured, as well when the due supply of water is maintained, as when it is deficient, yet in *marine* boilers such like injuries never occur, except under the palpable fact of a deficiency of water on the part affected; either by its level becoming too low, from neglect, or, by reason of the motion of the vessel, the furnace plates becoming uncovered; or when, by the improper construction of the boiler, the water spaces are too confined, and the free action of the water is obstructed. Here we have a cue to the solution of the question—to what is the overheating attributable, while a sufficiency of water still remains in the boiler? It suggests to my mind this answer—to the interposition, not of the incrustation, but of some really non-conducting medium between the water and the plate; this alone can be the cause of an overheating of the plates, concurrently with an adequate supply of water.

If under the circumstances of a non-conducting body being so interposed, the overheated plate be a sound one, it will yield to the internal pressure from the steam, and be merely bulged—a circumstance of almost every-day occurrence in marine boilers; but, if it be an unsound one, and imperfectly manufactured, by reason of the laminæ not being adequately welded together, a blister, and possibly rupture, will follow the bulging.

If the plate be a sound and solid one, the bulging will more or less assume the following appearances:



the exact figure being governed by the extent or peculiar character of the plate, and extent of temperature. If the plate be imperfect, (and such imperfections cannot be detected by any external examination,) the section of the laminated part will present an internal line of separation or disconnexion between the two sides, thus:—



the intermediate line being that of the separation,—as though they had been two distinct plates welded together at the surrounding parts alone.

Under these circumstances it will be easily conceived how the internal space, occasioned by this apparently double plate, or divergence of the two parts, will itself present an obstruction to the transmission of the heat, and, by its manifest weakness, convert what would otherwise be a mere harmless bulge, into a crack, or bursting, by which the escape of the water will be facilitated.

Now the interposed non-conducting body, since it cannot be the crystallized solid incrustation, must be the only other description of deposit met with in boilers, namely, a loose, unconsolidated earthy, muddy, or limy substance, which is usually a muriate, carbonate, or sulphate of lime, held merely in suspension from its not having arrived at the point of concentration, or, perhaps, not containing the exact proportional quantities or temperature due to the act of crystallization.

This floating and suspended mass, after precipitation from the water, subsides on the water being left at rest, and in a few hours becomes a compact and indurated, though still porous body, not unlike the state of an-hydrous sulphate of lime commonly called "plaster of Paris," after being supplied with a due portion of water. This matter having been allowed to cool, becomes hard, and from its porous nature a manifest non-conductor when accumulated in a mass; after having naturally subsided to the lowest parts, namely, to the centre of cylindrical boilers, and the sides or legs of wagon boilers, in this state it cannot be dislodged or acted on by the water, and thus directly becomes the cause of overheating and injury.

This also accounts for the fact mentioned by many, of the tendency of boilers to rupture or explosion when the steam has been first raised to a high pressure after a period of rest. The non-conducting character of this indurated mass when it forms a solid stratum of two or more inches in depth, I have substantially proved. In one of the vessels already mentioned, I had the iron bottom (½ inch thick) so filled in with solder, that, in the event of its being overheated, the solder would melt, and the bottom fall out, and the event proved the correctness of my anticipations. I first subjected it, with the due supply of water, to a great heat, the water boiling fiercely, and without any injury to the solder or bottom. I then dropped in, to the depth of about 2 inches, a portion of this loose matter, finely sifted, which I had myself taken from the interior of a boiler in work in Manchester. After boiling up the mass without producing any effect on the bottom, I allowed it to settle and cool down, and become solidified, or indurated. On again subjecting it to the same temperature, the water became heated very languidly, and in a short time the bottom became overheated, the solder melted, and the water ran through. On examining the interior immediately, I found the water had not penetrated through more than one-half the mass, the portion near the bottom having apparently become harder—so hard, indeed, as scarcely to be marked by the nail, and quite dry. Here then was the mystery solved, and a true source of overheating manifested.

With your permission, I will continue this subject in my next communication

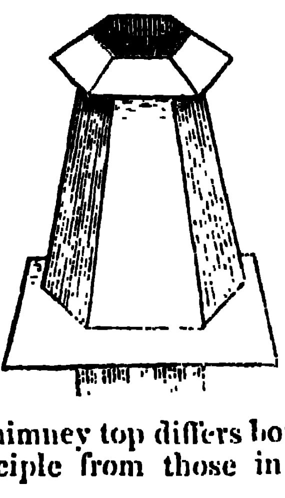
I am, Sir, &c.

C. W. WILLIAMS.

Liverpool, December 6, 1841.

## KING'S RAREFYING METALLIC CHIMNEY TOP.

(Registered pursuant to Act of Parliament.)



This chimney top differs both in form and principle from those in common use.

The funnels generally used for raising chimneys beyond the influence of currents are externally *circular*, and are consequently continually enveloped in the eddies which their own form is calculated to produce, while the revolving and other cowl heads are very unarchitectural and unsightly.

Mr. King's chimney top is so made as

to present horizontally, or vertically, *angles* to *divide* or *counteract* the *force* of strong gales, and sudden gusts of winds or eddies proceeding from currents of air obstructed by hills, high buildings, or trees; so that the wind striking against the bevelled top part, one portion of it is carried below the opening, while the other portion strikes upward, and passes over it in a curve sufficiently high to allow the smoke to escape without obstruction. The wind in its transit upwards producing a quick exhaustion of the air within the flue, and causing the smoke to be emitted with an increased velocity, proportioned to the force of the wind, from whatever quarter it may blow.

Again, this chimney top differs from all others in this respect, that it is made of two substances of metal with a space or chamber between them which is filled with air, whereby the inner tube or flue is protected from cold and wet, (which produce condensation,) and is kept in a rarefied state. And the vent is so perfect as to afford no obstructions, for the accumulation of soot, and offers *every facility for sweeping most perfectly by machinery.*

The inventor very sensibly adds, that should his chimney tops fail in the cure of *every* smoky chimney, they will at least render the smoke vent so perfect that they need never be removed, for we may be assured that the defect is not then in the top, but in other parts of the flue.

## PILBROW'S CONDENSING CYLINDER ENGINE.

Sir,—I have been compelled to delay replying to "Scalpel" in No. 919, having been called into the country on important business, and also wishing to reply in the same paper to Mr. Cheverton and any others on my engine.

"Scalpel" is too acute not to see that it is impossible for me to answer his questions with any positive result, and I doubt not he knows very well that the diagrams from which the actual power is computed in marine engines are no guide for the consumption of fuel. The engines of the *Great Western*, we are told by the editor, are nominally 400-horses power, but work up to 600-horses power, and burn only 4·66 lbs. of coals per horse power per hour upon that actual power, (see p. 278, No. 917,) and that "these statements have been derived from the most authentic sources," (p. 314, No, 949.) Now "Scalpel" cannot but see that these are not the proper data to go upon,—not those facts which in other matters discussed by him he so properly insisted upon having. The expansion gear of the *Great Western* can be adjusted to cut off the steam at different parts of the stroke. If the indicator be applied when the steam is working full pressure throughout, we shall have an actual pressure far exceeding that when the steam is cut off, and working at its least or at its medium pressure. If the first result is taken as the *general, and not as the occasional actual* power of the engines, and the gross quantity of coals in a voyage, computed upon that highest working, every one will perceive that an erroneous estimate is the result, one very favourable to the engines, but very deceptive to the public.

Suppose, for instance, that for four or five strokes at full speed and full steam throughout the stroke, the diagrams are taken; the very next stroke, and so throughout the voyage, more or less, the steam is cut off, what guide is this for consumption of fuel on the actual working? The consumption of fuel is subject to no variation, the actual power is; yet a variable and invariable quantity are lumped together without rule, sense, or propriety. Of the real gross quantity of coals consumed in a voyage, there can be no mistake except a wilful one, which I do not insinuate for a moment; but when it is well known that a steamer does not require her full power at all times, and that the expansion gear is changed many times during the voyage to give the less power, it follows that every variation in the actual power should be carefully ascertained, the average determined at the end of the voyage, and the quantity of coals calculated upon such average, not upon the extreme power working for a short time only.

It has been proved that the economy of marine boilers in evaporation and combustion, and their non-radiation,

are little inferior to those of Cornwall, and such careful stokers are now employed, and such strict injunctions given for the credit of the makers of the engines, to reduce the consumption as low as possible, that I am satisfied very little of the inferiority in duty of these engines can be fairly attributed to these causes. We can hardly suppose that Mr. Field, Mr. Miller, Messrs. Seawards, and other eminent engineers, are not as well acquainted with the importance of carrying out these requisites to their extreme limit, as the engineers of Cornwall, and especially when the least possible consumption is far more requisite.

The difference of expanding steam at 5lbs. in the *Great Western*, and 30lbs. in Cornwall, does not amount to more than 25 per cent. of the duty. I would ask then, to what cause can be attributed the remaining difference in effect, the Cornish engine doing 125,000,000, the *Great Western* but 43,000,000? Only to the more complete evacuation of the cylinder of the Cornish engines, *procured without sacrifice*, that is, without throwing away any of the steam pressure, as is now done in the marine engines to get a more perfect cylinder exhaustion.

I believe "Scalpel" will find that his opinion of the equality of Mr. Watt's engines forty years ago to the best of the present day, is fully borne out by one (at least) of the best living authorities, taking, as "Scalpel" has allowed for, the difference between the use of full steam then, and its expansion now.

In reply to Mr. Cheverton, (No. 952,) I would observe that he does not seem quite to be aware that the superiority of my engine is independent of any increase of duty from superior management of the present engines, better clothing, boilers, or such matters. When science shall have brought all these minutiæ to the utmost possible perfection, my engine will then be equally valuable as now. Whatever the difference may be proved to be between the best cylinder exhaustion it is possible to get in marine engines, and that in Cornish lifting engines, that my engine will save. This, I maintain, (with the better extreme vacuum,) is equal to 2lbs. on the square inch in the very best engines, calculating, of course, the loss of steam pressure by the early opening of the eduction valve to obtain the good exhaustion. And when *proper* returns of the duty of marine engines are made, and their accuracy investigated with the same diligence and nicety as the Cornish reports, then will the greater consumption of coals than the Cornish engine fully bear me out, that when the difference due to a less steam expansion is taken into account, the inferiority in duty of the marine engines can only be attributable to the cause of a less exhaustion of at least the amount I have stated.

I do not think it necessary to comment upon that part of Mr. Cheverton's paper where he thinks the Cornish advantages of a pause and slower speed of piston may be obtained in steamboats, because to do this, the size, weight, and greater expense would evidently more than outweigh the advantages. And if they do not--as my engine, by obtaining the vacuum every previous stroke, can nearly double the present speed of piston, *in the same sized engine*, the diminished weight, space, and cost must ever give it a superiority which every purchaser will prefer. Engine for engine of the same size and power, even should the speed of piston be intended the same, any manufacturer will now make my engine cheaper than the present, which would alone give to any house an advantage.

I am, Sir,

Yours, obliged and respectfully,

JAMES PILBROW.

Tottenham Green, December 6, 1841.

P.S. I have just read Mr. Cheverton's last, and *very long* communication, which I will take the earliest opportunity of answering.

CONSTRUCTION OF STEAM-BOILERS.

Sir,—Convinced that the explosions incident to steam-boilers, are caused by the pressure of the elastic fluid in the boiler; and that such of them as happen at the starting of the engine and letting off the steam, originate in the sudden and unequal contraction of the boiler, consequent on the issue of steam from it, at a time when it is in a state of extreme tension: allow me to suggest, in the pages of your valuable

Magazine, that, the pipes or tubes through which the steam passes to the piston of the engine, and to the safety-valve, should be carried 8 or 10 inches into the interior of the boiler; so that, when the steam is put on the engine, or let off at the safety-valve, the draught may be from the centre, or at all events, from the interior, of the mass of elastic fluid in the boiler, instead of from the side; and then, the contraction, consequent on the issue of steam, would be distributed more equally throughout the boiler, instead of being confined, as at present, to one place.

A boiler on this construction, I think, would be secure from those explosions to which boilers are liable, at the starting of the engine, and the sudden letting off of the steam, without having its efficiency impaired.

I am, Sir, yours with much respect,

K.

## THE THAMES AND CLYDE STEAMERS.

Sir,—Circumstances having prevented me from answering "Shipwright," "L. P." and Co., I now take this opportunity of replying to them.

I must in the first place correct my statement of the pressure the *Wallace* carries in her boilers, which is 6, instead of 7 lbs., which will make the actual power less than I stated. I think "L. P.," however, takes an unfair advantage of my statement of the actual power the *Wallace* has, when he asks why she did not "beat the *Duchess*, a vessel much larger, with only 140-horse power?" If he has seen the engines at all, he must know that the *Duchess* has larger cylinders than the *Wallace*; if he has not seen them, he ought to have informed himself as to the real state of the case. But as "Vulcan" states she did beat the *Duchess*, although she had 30 tons of coals on board, and 40 persons more than the crew," and the *Duke* only beat her five minutes, and would not have done so had she not had to slack her speed three times to allow sailing vessels to pass, ("L. P." takes no notice of these facts,) I can tell him something more to her credit, namely, that she went into Boulogne on the 14th of last month in a gale of wind when no other boat could, and was loudly cheered by the multitude assembled on the pier to witness her arrival. So much for the credit of the Clyde!

"Shipwright" appears to say that I assumed *superiority* for the Clyde boats. Now I did no such thing, as I claimed two or three miles per hour less than the Londoners do. I did not say that the *Turk* required less repair, neither did I say that she required less fuel; I merely said, that if she had given more satisfaction than any other, (by satisfaction, we must understand that she possessed some of these qualities,) "the *Turk* was never considered equal to the *City of Boulogne* in speed, &c.!!" Why the *Turk* could sail round the *City* with twice her cargo, and she can go through a sea against a head wind, when the *City* can make little, if any progress. In answer to my question why London Companies buy Clyde boats? Shipwright says, "it is on account of their cheapness." Now that is surely not the only reason. I should suppose the Commercial Company can count £. *s.* and *d.* as well as any other Company, and it is not at all likely, that with all the wisdom of the 19th century they would purchase boats which they knew would cost them four times the expense to keep up, although got one-fourth cheaper.

"Dicque" has let the "cat out of the bag" with regard to the pressure the Thames boats carry. Indeed so high is it carried, that the percussion is felt when the steam is first admitted into the cylinder. No wonder then they should be made to go quicker than the Clyde boats, and small praise is due to them if they do.

According to "L. P.'s" statement, the paddles of the *Railway* go about 20½ miles per hour when at their maximum speed. Now I venture to say, that the boat will not go above 16 miles, if it go that much, as there is fully one-fourth of loss on account of the fluidity of the water; at least we find the case so on the Clyde. But why cannot he mention decidedly the pressure the *Railway* carries? And why won't the proprietors of the *Blackwall* state to the public the pressure that boat is worked at? Fair answers to these questions would set suspicion and fear at rest. High pressure boilers are just as safe as low pressure ones, if proved in the same proportion; but to use high pressure steam-boats and compare them with those that use low pressure steam-is by all "manner of means" unfair.

I am inclined to think that the *Railway* must carry not less than 10 lbs. of steam, if the paddles go at the speed "L. P." states. Some of your correspondents say that I have been unhappy in my selection of specimens of the Clyde boats. I said there was none of them counted first-rate: I merely mentioned the *Wallace*, &c. as they happened to be bought about the time I was writing, by the same Company that bought the *Turk*, which had given so much "satisfaction." I could mention many other Clyde boats: need I men-

tion the *Fire King*, which accepted the challenge of the crack London boat for 1,000 guineas—a challenge from which the Londoners instantly drew back? Or may I mention the *Perth* and *Dundee*, the first good sea boats the Londoners ever had? Or may I be allowed to mention the *Princess Royal* on the Glasgow and Liverpool station, which made the passage from Liverpool to Greenock in about fifteen hours? Or the Halifax packets? Nay, I may even claim some credit for the poor *British Queen* which has got such a hackling in your Magazine, because, forsooth, she could not beat the *Western* with little more than half the power in proportion to her tonnage. That they make good engines and boats in England, neither I nor any other person can deny; but why claim to be superior to all the world, when they have not shown any thing to boast of except when obtained (as appears in the case of the *Blackwall*,) by unfair means?

I have a course to suggest, which I hope some of the Londoners who own these crack boats will adopt, namely, that they will send two or three of their flyers to compete with the Greenock and Glasgow Railway. They would perform the distance by water in little more than an hour, which is about the same time as the railway trains take, and would doubtless be preferred by travellers, as sailing is a much pleasanter mode of conveyance than by railway. For this suggestion (if put in execution) I claim $\frac{1}{10000}$th part of the profits, and I have no doubt that both they and I will make our fortunes, as the number of passengers is immense.

Craving your pardon for transgressing so far, I remain, yours, &c.

A. M.

Glasgow, Nov. 10, 1841.

### THE GENERAL STEAM-CARRIAGE COMPANY.

Sir,—If it be compatible with the wont of your Journal, I would put this question to the secretary or other members of the committee of the General Steam Carriage Company, mentioned by Mr. Beale in the 950th number of the *Mec. Mag.* Are they disposed to abet a Steam Carriage Invention, whereby a steam carriage of 30-horses power can be furnished complete for a less sum than the amount stipulated by Col. Maceroni, and which Mr. Beale will not ratify?

To save trouble, I may add, that I have now by me a 2-horse working model of a locomotive engine, which has been attached to a carriage three years ago, of such simple, yet efficient construction, that a steam carriage, with two engines and boiler complete could, and has been made of the weight of 2¼ cwts. per horse power, and at an expense of 10*l.* per cwt. Having seen in your Journal a notice and description of improvements in the evaporative power of steam boilers, by Mr. C. W. Williams, which I found out and reduced to practice three years ago, and being now, as then, in the same state of pecuniary inability, I make this enquiry with a view to secure, before too late, an interest in a valuable improvement remaining to me, for aught I know. It is upwards of three years ago since I constructed a cylindrical boiler 4 feet 6 inches long by 2 feet 6 inches wide, which had 1020 square feet of heating surface, on a principle somewhat different from the studded boiler of Mr. C. W. Williams, and which generated steam with a proportionate fire place to satisfy the demands of an 80-horse engine.

With improvements like these, if inventors and improvers were not proverbially the most abused class of society, I should not have had to wait three years in fruitless expectation of being able to satisfy the insatiable cupidity of British law.

If the ubiquity of your publication should be the means of producing a contact betwixt the inventor and capitalist, you will secure the gratitude of your obliged and humble servant,

DUNAMIS.

P. S. Any communication to Dunamis may be addressed to the care of the publisher of the *Mechanics' Magazine*.

### COLONEL MACERONI'S STEAM BOILER.

(ADVERTISEMENT.)

Sir,—My circumstances oblige me to crave "*in formâ pauperis*," that you would consent to insert the following advertisement in your Magazine.

MACERONI.

riage at the rate of 12 to 20 miles the hour, without any repairs.

Such a boiler of only eight feet cube is a two hundred horse power, weighing only sixteen tons. Two such boilers, *i. e.*, 16 feet by eight, is 400 horse power. The common steam-ship engines are calculated to weigh one ton per horse power. No injurious effects can possibly occur from the opening of Colonel Maceroni's boiler, if purposely made to burst, at 2,000 lbs. to the inch, as has been actually tried. All boilers are liable to burst, so the only really safe ones are those which if made to burst, can do no harm. Such is Col. Maceroni's.

Extract from the official report of a committee appointed by the House of Commons to report on the best means of saving the nine millions invested in turnpike trusts now received by the railroads. For the sake of brevity, the preliminary observations of Mr. Mackinnon, the chairman, must be omitted. Space can be only given for *one* of the witnesses examined.

"The Marquess of Tweedale deposed that he had in January, 1834, travelled in Colonel Maceroni's steam carriage to Uxbridge, Harrow and other places. The steam coach passed through Oxford-street just like the other carriages. When they got into the Uxbridge Road, they went at the rate of 15 miles the hour, and there was no noise or smoke; the road was covered with fresh loose gravel, and very wet.

"On our return from Uxbridge, on one occasion we stopped at the bottom of Notting Hill to take in water, when we were passed by an Oxford coach with as fine a team of horses as we had ever seen. A number of Oxford scholars cheered as they galloped by at full speed, but the Colonel followed up the hill and passed the coach, still galloping, and left it out of sight in a few minutes."

Many other noblemen and gentlemen who had ridden for months in the Colonel's carriage, gave similar satisfactory evidence, but it would require too much space to give them, or a tithe of them. Any gentleman with a little money and influence may make a fortune by the purchase of these patents, which are completed in England, Ireland, Scotland, and twenty sovereignties of the Continent.

P. S. The patent has only seven years to run, but in that time a great fortune might be made on common roads and in steam navigation. I would make a little improvement to the boiler, that would much increase its durability.

62, Pratt-street, Lambeth, Nov. 18, 1841.

## NEW COMPOUND OF CARBON AND SILICA.

Sir,—When five or six parts, *by bulk*, of silica powder are intimately mixed with one of charcoal or plumbago powder, and the mass exposed, under chalk or sand, for a few hours to nearly a white heat, I find, by repeated experiments, the mass enters into fusion and combination; the silica alone is well known not to fuse at a heat below that of the oxy-hydrogen blow-pipe.

H. PRATER.

December 2, 1841.

## ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS, RECENTLY ENROLLED.

*** *Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for that purpose.*

MILES BERRY, OF CHANCERY-LANE, GENTLEMAN, *for certain improvements in machinery or apparatus for ruling paper.* (A communication.) Rolls Chapel Office, December 9, 1841.

The machine which constitutes this invention is constructed upon the principles of the ordinary cylinder printing machine; and consists, first, of a reciprocating motion, which carries the paper to be ruled; secondly, of two cylinders covered with cloth, above which cylinders is placed a carrying roller, that draws the sheet of paper brought by the reciprocating motion, and conveys it into the machine, where it is passed round the cylinders and maintained in contact with them by means of a suitable arrangement of cords or bands, which, by their peculiar disposition, also turn the sheet of paper after one side has been ruled, and present the contrary side to the pens or ruling instruments; third, a wiping or drying roller, covered with blotting-paper, which revolves in contact with one of the cylinders, and absorbs any ink that may be transferred thereto from the ruled side of the paper; fourth, of a number of pens, or ruling instruments, suitably arranged and mounted; and fifth, a convenient disposition of ink or colour troughs, or holders for containing the different coloured inks.

The axle of the shaft which carries the pens turns on its centre, whereby the pens are moved to, or withdrawn from, the paper as required. The pens are supplied with ink in the following manner:—When they are withdrawn from the paper, the ink troughs are made to ascend, and dip the nibs of the pens into the ink, which rises into the body of the pen by capillary attraction; the ink-trough then descends, and remains.

There is an arrangement of tapes or threads, which carry the ruled sheet out of the machine, conduct it to a certain distance, and deposit it in a box placed there to receive it.

A winch-handle is attached to the upper cylinder, for the purpose of turning it, and by means of a toothed wheel mounted on the axis thereof, and which gears into a similar toothed wheel on the axis of the lower cylinder, the latter is made to revolve in an opposite direction, and motion is thereby communicated to the whole machine.

☞ *Intending Patentees are informed that they may be supplied gratis with Printed Instructions, containing every particular necessary for their safe guidance, by application (post-paid) to this Office, where is kept the only* COMPLETE REGISTRY OF PATENTS EX-

TANT (*from* 1617 *to the present time*); *Patents, both British and Foreign, solicited. Specifications prepared or revised, and all other Patent business transacted with economy and despatch.*

## LIST OF PATENTS GRANTED FOR SCOTLAND BETWEEN THE 22ND OCTOBER, AND THE 22ND NOVEMBER, 1841.

Joseph Wright, of Carisbrook, Isle of Wight, mechanic, for improvements in apparatus used for dragging or skidding wheels of wheeled carriages. Sealed, October 27.

Robert Logan, of Blackheath, in the county of Kent, esquire, for improvements in obtaining and preparing the fibres, and other products of the cocoa nut, and its husks. Sealed, October 27.

Joseph Chisild, of Tiverton Mills, near Bath, for improvements in the manufacture of manure, or composition to be used on land as manure. Sealed, October 27.

Alfred Jeffrey, late of Prospect-place, New Hampton, in the county of Middlesex, and now of Lloyd-street, Pentonville, in the same county, for a new method of defending the sheathing of ships, and protecting their sides and bottoms. Sealed, October 27.

William Neilson, builder, residing in Glasgow: and David Lyon, residing in Tradeston, of Glasgow, both in the county of Lanark, and Peter M'Onie, engineer, residing in Kining-place, Glasgow, in the county of Renfrew, all in Scotland, for a mode, or modes of, or an improvement, or improvements in cutting, dressing, preparing, and polishing stones, marble, and other substances, and also in forming flat, or rounded mouldings, and other figures thereon. Sealed, October 29.

James Whitelaw, of Glasgow, in the county of Lanark, and James Stirrat, of Paisley, in the county of Renfrew, manufacturer, for improvements in rotary machines, to be worked by water. Sealed, November 3.

Martin John Roberts, of Brynycaeron, in the county of Caermarthen, gentleman, and William Brown, of the city of Glasgow, merchant, for improvements in the process of dyeing various matters, whether the raw material of wool, silk, flax, hemp, cotton, or other similar fibrous substances, or the same substances in any stage of manufacture; and in the preparation of pigments, or painters' colours. Sealed, November 10.

John Annes, of Plymouth, in the county of Dev[illegible] ed [illegible] ethod [illegible] making paint from materials not before used for that purpose. Sealed, November 12.

William Palmer, of Sutton-street, Clerkenwell, in the county of Middlesex, manufacturer, for improvements in the manufacture of candles. Sealed, November 17.

George Bent Ollivant, and Adam Howard, of Manchester, millwrights, for certain improvements in cylindrical printing machinery for printing calicoes and other fabrics, and the apparatus connected therewith, which is also applicable to other useful purposes. Sealed, November 17.

John Leward, of Wolverhampton, in the county of Stafford, esquire, for improvements in the construction of piano-fortes. Sealed, November 22.

## LIST OF IRISH PATENTS GRANTED IN OCTOBER, 1841.

L. Larbenal, for improvements in machinery for cutting cork.

Thomas W. Berger, for improvements in the manufacture of starch.

T. Young, for improvements in lamps.

F. Hundrycke, for certain improvements in the construction and arrangement of fire places and furnaces applicable to various useful purposes.

## NOTES AND NOTICES.

*The wreck of the "Telemaque."*—The *Havre Journal* of the 19th, states that, on the evening of the 17th, an English brig, descending the Seine from Villequier, was driven by the force of the current, and of the storm then raging, past Quillebœuf, where the pilot in vain attempted to anchor, and would have been inevitably lost, with all hands, had she not run foul of the works carrying on for the salvage of the well-known wreck of the "Telemaque," which was lost on the 3rd of January, 1790, opposite the Phare of Quillebœuf, in the most dangerous part of the whole river. The vessel was by this means saved, with very little injury; but the shock so far damaged the works, which were within four days of completion, that it would require at least a fortnight to reinstate them in their former position. Under these circumstances, the parties who are occupied in the salvage have decided to suspend their final operations until next season. The works have been carried on for the last two months in the midst of the most stormy autumn known for many years in the Valley of the Seine, with enterprise and vigour worthy of our countrymen, and, hitherto, without any accident, and with ample success; but the ice that, in a very short time, may be expected to descend the river, and the storms that almost daily accompany the rise of the tide, render the prosecution of the enterprise during the winter, not only, as has been the case hitherto, difficult and dangerous, but absolutely impracticable. The "Telemaque" contains a very large amount of treasure, with which many *Emigrés* of distinction were endeavouring to leave France at the commencement of the Revolution.—*Patriot.*

*A Lengthy Project.*—Mr. Burden, the American, whose twin cylinder steam-boat excited, some years ago, so much attention, is again intent on "astonishing the natives." He now proposes to construct a steam-boat 750 feet long, for the navigation of the Hudson, divided into three sections, with an engine in each, similar to a train of railroad cars, or locomotives. Each of the present boats, he says, has to dig or excavate a passage in the water equal to the cross section of the boat. Mr. Burden argues that as in his long boat only one canal would have to be excavated, the entire power of two engines might be saved, and applied to increase the speed of the first boat or section, for, in converting three boats of 250 feet each into one boat of 750 feet, the said boat can be so formed as to pass through the water at high velocities at much less resistance than one of 250 feet. He thinks boats may be constructed so as to answer every purpose of river navigation, and, by lengthening the train, increase the speed *ad infinitum.*

*A Revolution in Agriculture.*—There has been much said in the journals lately of a process by which grain is produced without tilling, manuring, or harrowing, and in the poorest soil. The discovery, which, as yet, must be looked on as problematical, consists in merely covering over the grain with a layer of straw, by which simple means germination is induced, and a crop obtained. The following are the results of experiments which have been made by Messrs. Charles Paillard, and Bernard de Brest:—"In a field sown with rye," say they, "because the soil, according to the farmer, was too poor for wheat, a strip, neither ploughed nor dunged, of about 160 feet square in extent, was put at our disposal. This fallow ground we manured, and covered with straw to the depth of about an inch. Next, in a garden, the soil of which is the worst possible, and which has received no manure for many years, we scattered wheat covered over with

straw. Finally, to establish more fully the fact that the ground is nothing more than a means of support, we placed twenty grains on squares of glass, and these also we covered with straw. Germination soon manifested itself, and under the finest appearances. The winter was very severe. The exposed ground of the garden was frozen to a crust of upwards of six inches in thickness, more than once during the season, and many plants perished, whilst, beneath the straw, the same ground remained soft and light, and the seed consequently uninjured. In the spring we had long droughts; and, whilst all around suffered from them, our stalks, rooted in a moist soil, thanks to the straw, grew vigorously. We had the finest possible harvest. Some of our stalks grew to 6 feet in height, bearing fifty, sixty, even eighty-two grains, large, and exciting the admiration of the curious, who came to look at them. Above all, the wheat on glass excited their astonishment; amazed at seeing that, without the smallest foundation of earth, and unwatered, the ears were as fine and full as those sprung out of the ground."—*Journal des Debats.*

*Dry Milk.*—Kirchoff, a Russian chemist, who discovered the process of converting starch into sugar, has made several experiments on milk, by which it appears that that fluid may be preserved for use for an indefinite time. Fresh milk is slowly evaporated by a very gentle heat till it is reduced to powder, which is to be kept perfectly dry in a bottle well stopped, for use. When required, it need only be diluted with a sufficient quantity of water, the mixture will then have all the taste and properties of new milk. This powder must prove a valuable addition to a sea stock of provisions.—*Standard.*—[An Irish friend of ours, on hearing of this dry milk, observed, that he saw nothing at all surprising in it, for "sure there were *dry* nurses, as well as *wet*."]

*Tower Fire Engines.*—In consequence of the inefficiency of the six engines belonging to the Tower, at the late fire, they were on Tuesday last brought out for inspection and trial. The water tanks were, upon this occasion, nearly filled, and the engines manned by a fatigue party of the Scots Fusileer Guards, under the personal superintendance of Mr. Smart, the engineer. The engines were found to be very inefficient, principally owing to the defective state of the suction pipes; and all of them were pronounced to be too small and powerless to meet the requirements of the Tower garrison.

*Whitworth's Mechanical Street Sweeper.*—We have this week witnessed, in Manchester, the very streets swept by machinery. The machine in question is in the form of a cart, drawn by one horse, the motion of which impels a number of revolving brushes, which take up the dirt into the body of the cart itself, as the receiver, upon the same principle, substituting brushes for buckets, as the ordinary dredging machine in our docks.—*Liverpool Paper.*

*Mechanics' Institutions.*—The total number of Mechanics' Institutions at the present time in Great Britain is 216. The number of members is however, we regret to say, disproportionately small, being only 25,651, or, on an average, about 119 each. It appears further, from returns obtained by the Society for the Diffusion of Useful Knowledge, that the majority of persons who have availed themselves of these institutions are *not* of the class of mechanics, being made up in the proportion of at least six-tenths of master tradesmen, shopkeepers, clerks, &c. In point of fact, therefore, most of these Mechanics' Institutions are so in name only, and it would be wrong to consider them as at all representing either the desire for scientific knowledge which exists among the working classes of Great Britain, or the extent to which it is actually cultivated by them. That they have failed in so great a degree to accomplish the object they had in view, is owing, we apprehend, chiefly to two causes: firstly, to the information supplied at them being but too generally of a character ill adapted to the intellectual wants of the working classes; and, secondly, to the working classes not having their natural and proper share in the management of them. To insure a constant supply of the sort of information which mechanics are most in need of, and to induce the general body of mechanics to take to these institutions *as their own* peculiar fountains of knowledge, they should have been allowed, like other people, to *manage their own*, and had they been so, we think it probable they would have been ten times more successful.—*Mechanics' Almanac.*

*All-triumphant Steam.*—(From a Bristol Correspondent.)—The *Great Western* fired her signal of arrival in Kings-road, (ten miles from this city, at the mouth of the river,) at half-past ten on Monday night, thirteen days only from New York. The reporter of the *Times* went on board, and left her again with the despatches, in an open boat, and in a gale of wind, before eleven. He reached London by the mail train, at half-past five. The intelligence was printed, and despatched again to Bristol by one of the regular trains, and a copy of the *Times* was in the cabin of the *Great Western*, in the roadstead, by one o'clock, P.M. These are the wonders of steam navigation, steam travelling, and steam printing.

*The British Queen and President.*—It appears from a statement which has been published of the affairs of the British American Steam Navigation Company, by whom these unfortunate vessels were built, that the average receipts for nine voyages made by the *British Queen* were 9,111*l.* 1*s.* 8*d.*, and the average expenses, 7,851*l.* 11*s.* 2*d.*; while the average receipts for three voyages made by the *President* were 8,441*l.* 15*s.* 6*d.*, and the average expenses, 7,291*l.* 7*s.* 10*d.* In both cases, therefore, there was a profit, though not great, earned, and that under circumstances by no means favourable to success.

*Mr. Brunel.*—The *Mechanics' Almanac*, whose able exposure of the absurd doctrine propounded by this gentleman before a Committee of the House of Commons, "that educated and thinking mechanics make the worst engine-drivers," we lately noticed, thus smartly hits off the character of the engineer of the Great Western. "His strain of argument on the subject before us coincides remarkably with nearly all else that he has done to show, that his is not the mind which founds large designs on calm, extensive, and philosophic application of ascertained principles; his mode of proceeding is rather the venturous and resolute prosecution of many and bold expedients. Accordingly, he splendidly succeeds, or unblushingly fails. To those who love the dashing chance, we cannot recommend a leader more likely to win brilliant prizes for them; but they must be content if he draws for them a blank. His undoubted talent and untiring perseverance will always place him high amongst his compeers; we only regret that they are not associated with sounder philosophy and more careful thought. Perhaps, however, we are wishing for too much. No man can be every thing; and it may be that Providence, who uses each for the good of all, uses Mr Brunel for the accomplishment of purposes which wiser men would not dare attempt."

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# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 958.] SATURDAY, DECEMBER 18, 1841. [Price 6*d*.

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GIBBS'S IMPROVEMENTS IN PROPELLING.

Fig. 1.

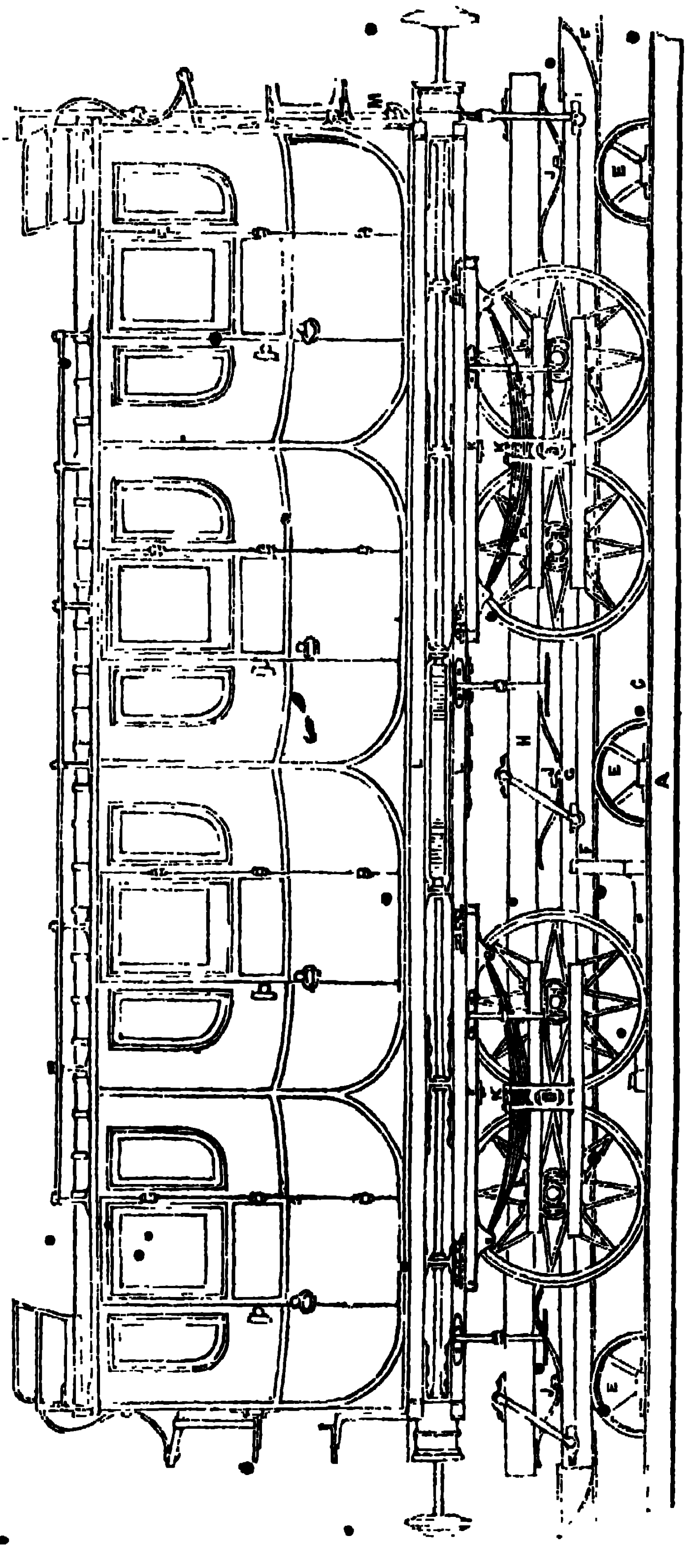
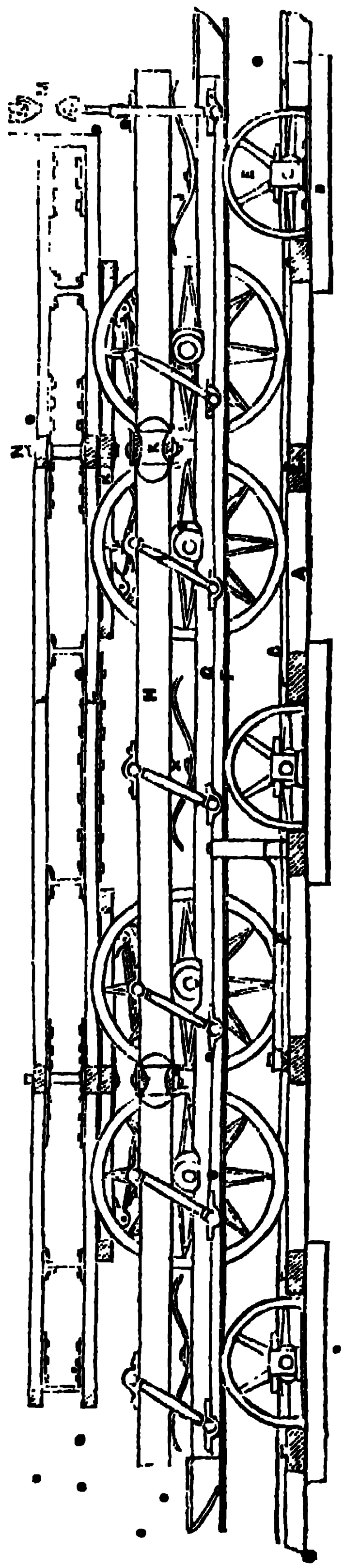
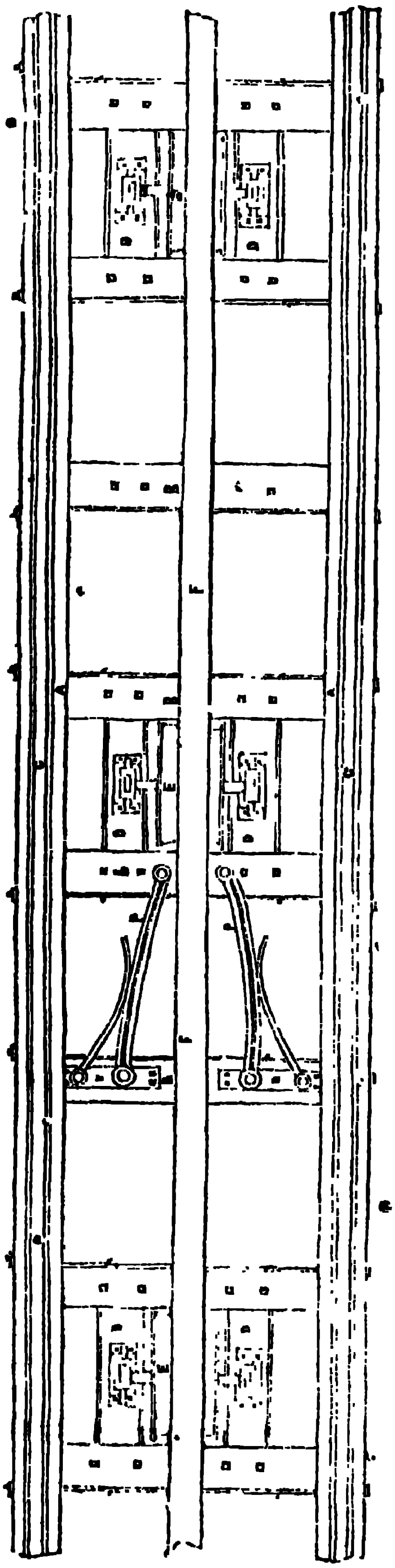


Fig. 2.



GIBBS'S IMPROVEMENTS IN PROPELLING.

Fig. 4.



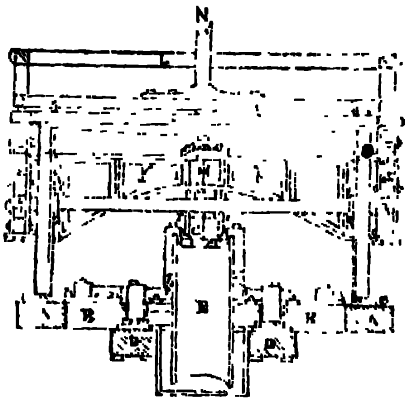
In our last number we noticed in detail the difficulties which are opposed to locomotive progression on lines of road which deviate from a perfect level, and described the improvements recently patented by Mr. Taylor, with a view to obviate (within certain limits) these difficulties.

We this week lay before our readers another contrivance for the same object, which, by a singular coincidence, was patented on the same day by Mr. Joseph Gibbs, C. E. The manner in which this gentleman proposes to accomplish the end in view will be explained by the following extract from his specification.

Fig. 1 (in our front page) is a side elevation of a railway carriage, and fig. 2, a longitudinal section of the same. Fig. 3 is a transverse section; and fig. 4 is a plan showing part of the railway, friction wheels, and endless band or rope, constituting these improvements.

A A and B B are longitudinal and transverse sleepers, framed flush, and held together by iron ties or rods. Upon the sleepers A A the rails C C are laid, and fixed in any approved manner. To some of the sleepers B B, at convenient distances apart, are attached other sleepers D D, upon which are fixed the bearings of friction-wheels E E. On some of the sleepers B B are also fixed levers P P, which are acted upon by springs, and carry friction-rollers, which are intended to carry an endless band or rope F F, and keep it in the centre of the line. G G is a beam or bar, (called a compressing bar,) of wood or other material, which is suspended from, and kept parallel with another bar, H H, by rods or bars I I. Between the said beams or bars are fixed any convenient number of curved springs J J, which are intended to press the bar G G against the band or rope, to obtain the necessary amount of adhesion; K K is a frame at each end of the carriage, upon which are placed the springs and the wheels of the carriage. The wheels are in pairs, on each side of the carriage, and as near to each other as is convenient; a double pair being upon each of the frames, as shown in figures 1 and 2.

Fig. 3.



Attached to this frame is another of iron, or other suitable material, which supports in its centre the beam or bar G G, as shown in figures 2 and 3. This frame has also in its centre a vertical shaft or axle, N N, passing through the lower frame of the carriage; and upon the upper surface of the frame K K are small friction-rollers upon which the carriage rests; L L is the lower framework of the carriage; M M is a contrivance for raising or depressing the bar G G, as occasion may require.

The endless band F F passes round drums, at proper distances apart, to which motion being communicated from a stationary steam-engine, air-engine, or other prime mover, the band is caused to advance slowly between the friction-wheels and the compressing bar, the adhesion produced thereby communicating a continuous motion to the band, by which the bar H H, and the carriage attached thereto, is moved forward. When it is required to check the speed of the carriage or carriages, the compressing bar is raised clear from the surface of the band or rope.

## ON THE PROTECTION OF PUBLIC BUILDINGS FROM FIRE.

Sir,—The destruction by fire, of one public building after another, may hereafter, possibly lead to some share of attention being paid to remedial measures, the total absence of which, in several recent cases, has been strikingly and fatally shown.

In many of our public edifices no provision against fire is attempted, either as regards prevention or cure; while others, wherein a semblance of protection is affected, are in reality as destitute as the former.

To accomplish any real good in this way, three things are essential, viz.: An abundant, and readily available supply of water—engines of a proper size, in good working order, and in perfect readiness for use—and, a skilful and experienced person to make a judicious application thereof.

In very few establishments, are these essentials to be found combined; at the Houses of Parliament they were not: nor at the Royal Exchange; and although the Bank of England could boast the two former, yet this edifice had nearly fallen a victim to the flames a few years since,* for want of the last. At the recent conflagration at the Tower, the water was neither "abundant" nor "readily available"—the engines were neither of a proper size, nor in good working order—and the party upon whom it devolved to make a judicious application of them, being the only person acquainted with, and responsible for the supply of water, it was utterly impossible for him to be at the water-works, at the tanks, at the main pipes, and superintending the working of six fire-engines in different places, at one and the same time.

The thorough inadequacy of the water supply was clearly established before the Committee of Enquiry, who state in their report, "that had the engines been dependent on the tanks alone for water, every building within the Tower defences would in all probability have been destroyed. And the Committee are of opinion, that *the arrangements in case of fire are imperfect*."

A writer in the *Times*, of Nov. 29, says, "I saw several of the Tower engines working with *four* lengths of suction, and I *know* that the engines in the Tower were *thoroughly repaired* a short time previous to the fire taking place." This, however, is altogether a mistake; none of the *Tower engines* worked through more than *two* lengths of suction, which is all they are provided with, and those were not in a condition to be capable of such an achievement.

* Vide *Mech. Mag.*, vol. xxvi. p. 472.

The narrative of an eye-witness, in the *Times*, November 3, contains the following particulars:—"It must be a source of great regret, that a building of such extent, and filled with articles of such extreme importance to the country, should have been permitted to labour under such a lamentable deficiency of water. It must be a matter of surprise, also, to know, that the engines and apparatus for extinguishing fire in the Tower were in a most wretched condition. Having been requested to set one of the Tower engines to work, I proceeded to do so, and had the choice of four or five engines, and six or seven suction-pipes, not one of which would fit any one of the engines! After much rummaging, a suction-pipe was found to correspond with one of the engines; but, alas! a short pole had been jammed into it, and rendered it useless."

Mr. Smart, (the engine-keeper,) in his examination before the committee, stated, that "the engine was got to work the moment it could be got up, but the power of the engine was not sufficient to throw the water over the grand store-house, where the fire was then raging, *although it was one of our largest engines.*" The present inefficient state of the Tower engines was, however, fully proved on Tuesday last, (the 7th instant,) when they were tried under Mr. Smart's superintendence. These engines appear also to have been wholly destitute of such implements as are usually considered essential to the equipment of a fire-engine; for it was proved in evidence before the committee, "that there was great difficulty in opening the fire-cocks and tanks, for want of the *proper means*, and that this was at last accomplished with a strong *poker*, which was bent in consequence!"

It is probable that the inefficiency of the engines, and the spread of fire in the Tower, is in a great measure attributable to the false notions of economy too frequently practised in these matters. The engines, which were said to have been "*thoroughly repaired*"—or, as more accurately described by some of the witnesses, to have been "*painted*," about two months previous to the fire—were, I suppose, "put in order" per contract. It so happened that I saw a statement, which was at that time prepared by a first-rate tradesman, of the repairs necessary to be done; in which the several defects were minutely detailed, and an estimate of the expense of putting them in a state of efficiency furnished. This estimate was, I dare say, as low as the work could be done for, without incurring a loss; but I suppose somebody put in a "*lower tender*," and got the job, still taking care to make it "*pay*."

Of all things in the world, repairs are the most difficult to execute (honestly) under contract; and fire-engines, above all other machines, the worst to be subjected to such an operation. In every such case, the repairs are sure to be done "as well as possible"—*for the money!*

"Any thing well done," says the old proverb, "is twice done;" and it is wretchedly bad policy, when a considerable outlay has been already incurred in providing engines, &c., to withhold the "trifle more" that would make them serviceable; and yet this is the common course of proceeding, in nine-tenths of public and private establishments.

Of public buildings, nearly all our churches, St. Paul's Cathedral, Westminster Abbey, the Palaces, the Mansion-house, the National Gallery, with many others, might be enumerated as being wholly destitute of protection against fire; while in many others, the provisions made are so imperfect, as in reality to be next to useless.

Among private buildings, we see warehouses, manufactories, club-houses, hospitals, theatres, chapels, halls, and dwellings of the largest class, wholly unprotected.

We must be, as Leigh Hunt once called us, a nation of "salamanders," or we should look to these things.

It will be well if the losses already sustained should lead to the more general adoption of preventive measures, for prevention is better than cure; and although it is desirable and necessary to provide ample and efficient means of extinguishing fires, which will occur, it will be more prudent, and far more successful, to adopt such precautions in building as are known to prevent the spread of fire.

Science has laid her richest stores at our feet, if we would but use them, and

our dwellings may now be constructed, or rendered, nearly fire-proof, at a very trifling expense. Should the insurance companies see fit to discontinue their present small, but highly efficient fire establishment, (and there is nothing to compel its continuance,) we should then rival our trans-atlantic friends in the magnitude of our conflagrations; whole streets, and squares, and houses by the thousand, falling victims to the unopposed and uncontrollable fury of the elemental destroyer.

Yours respectfully,

W. BADDELEY.

London, December 9, 1841.

### THE CAP OR DEFLECTOR LAMP, COMMONLY CALLED THE SOLAR LAMP.

Sir,—The readiness with which you notice whatever may be useful to the community, induces me to ask your permission to point out to your numerous readers, a matter which cannot fail to be interesting to most of them; indeed, which concerns the public. This matter is, the expiration of the Lamp Patent of Upton and Roberts, which took place last week. As this circumstance throws every part of the patent open to the public, it is but right the public should have what they are entitled to free of the charge, or impost of any one. I refer in particular to one of Upton and Roberts's contrivances, which is now in general use, but not, however, as their invention: I mean the cap, cone, or dome deflector, or, as it is now called, the solar lamp. This instrument, by whatever name it may be known, makes a prominent feature in Upton and Roberts's patent. They state in describing one of their lamps, that they pass the air to the flame under an inverted dish, which has an air aperture in its centre. This dish or deflector is placed over the mouth of the burner, and rises little more than half an inch above it, and carries the air admitted below its rim, into closer contact with the flame, than could be done, without risk of breakage, by a glass chimney. The flame and the air by this means are brought into contact, and pass together through the aperture referred to. Common oil is thus made to produce a flame of peculiar strength and brilliancy. This comprehends the whole contrivance of cap or deflector lamps, and consequently leaves the application of such an instrument, by whatever name known, open to the free use of the public. That no doubt may remain as to the accuracy of the information I am now giving, I beg to refer those whom it may concern, to a cap or deflector lamp of Upton and Roberts's, which may be seen at the Adelaide Gallery, where it has been since the year 1836. It was made about six years back by Timothy Smith and Sons, of Birmingham, who made some hundreds of them about that time, under Upton and Roberts's Patent for the use of the Staffordshire Collieries. These gentlemen can therefore, and no doubt will, readily give any information that the public may require on the subject. I remain, Sir,

Your obedient Servant,

A CONSTANT READER.

London, Nov. 29, 1841.

P. S. It is to be understood that I do not claim for Upton and Roberts the originality of the invention. My sole object is to give the public the free use of it. This their expired patent does, which therefore renders reference to previous inventions or patents unnecessary.

### MR. CROSS'S GALVANIC EXPERIMENTS.

Sir,—I should be glad to learn what is the construction of the Water Galvanic Battery, with which Mr. Cross has succeeded in forming metallic and other crystals? When he gave an account of his discoveries to the British Association, here, he merely said, that they were composed of copper and zinc cylinders, well insulated. Had he been more explicit, he would, I have no doubt, had many fellow labourers in this interesting pursuit, which he has himself struck out, and which promises so much. Should he see this, he will, perhaps, be induced to give a more particular description of his Battery, as well as the size of his cylinders, and how his more perfect insulation is effected; or perhaps some of your scientific correspondents will have the kindness to give the required information. I am, Sir,

Your sincere well-wisher,

QUÆRO.

Bristol, Nov. 29, 1841.

### THE CRANK

"What I have to communicate on this subject was originally deduced from experiments made on working models, which I look upon as the best means of obtaining the

outlines of mechanical science."—*Phil. Trans.* *vol.* li. 1759.

Sir,—The above words are taken from a very valuable paper, containing experiments on wind and water mills, written by the illustrious Smeaton, nearly a century back, and read before the Royal Society. If the engineers of the present day could only be induced to rely like Smeaton, more on their own practical researches, than on mathematical formulas, based in most cases on most imperfect theoretical data, the science of mechanics would no doubt be much benefitted, and we should not at the present day have such a question as the one at present under discussion left in so unsatisfactory a state.

In my last communication to your pages, I inadvertently committed an error, which I am most anxious to rectify, as it is a matter of some consequence with reference to the amount of a certain effect, though it does not touch the principle I was contending for in that paper. I stated, that when the weight of 37 lbs. was put in motion, by means of the shifting leverage, the power made use of and expended was represented by the number 200 as before. Now, this is incorrect, for the power made use of was certainly the same; namely, 50 lbs.; but as it moved over a space of only $\frac{8}{3}$ or 2·7 inches, nearly, to make the 37 lbs. move over the space of 4 inches, the power actually expended was 2·7 × 50 = 135 only. However, this, as I have said, does not affect my argument, for to make the weight of 37 lbs. be carried over a space of 6 inches, which it would be necessary to do if no power were lost, I must add something additional in the scale to the weight of 50 lbs., and for the purpose of my argument, it is the same thing whether that additional weight be only one ounce or 100 lbs. My argument is equally good in either case. I cannot conveniently at present repeat these experiments, but I will assume for argument's sake, that 5 lbs. additional weight would be sufficient. Then we have 55 × 4 inches = 220; when, if there was no power lost by the shifting leverage, the number representing the power expended would be only 200, and power equivalent to 20 would be lost or ineffectual.

Your correspondent "R. W. T." is mistaken, when he thinks the cross bar, placed on the table, in these experiments, represents the motion of a crank only when it comes up to, and turns on the stop; for, when the bar is moving two inches up to the stop, it represents the power of the crank, when that power, or rather the leverage, is the greatest, namely, when the crank is at right angles with the connecting rod, and when it arrives at the stop it represents the crank at an angle of thirty degrees from the dead point,—being the angle we were investigating; overlooking all the intermediate angles to facilitate the calculations. I think this explanation will be found necessary. To recapitulate what has been done, I have demonstrated by these experiments, that when the work required to be done by the engine, or, I should rather say, the resistance given by that work to motion, does not vary in intensity in the same proportion that the shifting leverage of the crank varies; then, in that case, there is an actual loss of power shown under the following four heads, for, when the work required to be done varied in the proportion of the variation of the leverage, as in the first experiment, where the weights of 58 and 28 lbs. were moved, there was no loss of efficiency (I use this term, as it seems to be at times less objectionable.)

1. There is a loss of power when the work to be done, and the power employed, have both momentums combined with the friction attendant on the work.

2. There is increased loss of power when the work to be done alone is deficient of momentum, but the power has it.

3. There is additional loss, when both the work required to be done and the power made use of, are deficient of momentum. And,

4. As a consequence of the second and third cases, there is a loss similar to the second case, when there is momentum in the work to be done, but none in the power made use of.

How then, let me ask, can mathematical formulæ be defended which do not embrace such elementary matters as these? And in what better manner than that pointed out by Smeaton, can an enquiry of such a complicated nature be investigated, namely, by experiment, and not such limited experiments as Mr. Clive, or as "R W. T." suggests, but such as will magnify and bring to view the minute action which takes place at particular angles

of the crank, and which varies so necessarily both the nature of the work and of the power made use of? Although the experiments I made were not devised for the purpose of ascertaining the actual loss of power consequent on the making use of a crank, but for the purpose of proving beyond a doubt, that a certain loss does actually take place, the demonstration of that fact (if my reasoning and experiments can be depended on,) must be allowed to be of primary importance in such a discussion.

In your able correspondent, Mr. Cheverton's observations on this subject, there seems to me to be a little inconsistency. He adduces no authority of any weight but that of the mathematicians in support of his views, and yet we see him at the same time lashing them with all his might for their incompetency! He cannot for a moment suppose that the universal adoption of the crank is an argument of any weight: he contends that for the purpose of a fair comparison of the crank and lifting engine, both engines should have a uniform motion, and for that purpose that the crank engine should be so contrived that the piston rod should move as slowly as that of the lifting engine; while his own party at the same time contend that there is more steam consumed by the latter engine, or, which is of course the same thing, that the piston rod moves quicker than the former. Such is the manner they blow hot and cold at the same time. It is evident that they mix up and confound two things in themselves perfectly distinct, namely, the unequal motion or speed of the piston rod of one engine in equal times, in each single stroke, with the comparative number of strokes or evacuations of both engines in given times; and because there is a great inequality in the case of the crank engine, the inequality in the other case must, forsooth, be in favour of their argument. Now, although the slow motion of the piston-rod of the lifting engines may be a good reason for some part of its superiority, it is a very bad one to prove that it consumes more steam than the other or crank engine.

The able paper in your last number, from the pen of Mr. Williams, proves what blunders these mathematicians will make, and what ridiculous pretensions they have, to make formulæ without sufficient data. As well might they attempt to give a formula for a daguerreotype sketch, or for an electrotype deposit, as to give one for the heating power of a boiler from the superficial area of the fire-place, or (to come nearer to the matter in hand,) a formula for the action of the crank as exhibited in my experiments. What formula, let me ask them, could be given, that would suit the experiment of the three balls described by Philo-Smeaton, in your Magazine lately, when the plugs were *unequally* penetrated into the centre ball by means of *equal* forces,—an experiment which at one period caused a sensation among all the philosophers of Europe? The principle, on which those who contend that no loss of power takes place in the crank take their stand, is that "where no steam is consumed, no power can be lost," but want of judgment and discrimination in applying this principle has brought them into their present troubles.

I am, sir,

M.

A MATTER OF FACT ANALYSIS OF "PRACTICE AND PRACTICIANS, *versus*, MATHEMATICS AND MATHEMATICIANS."

SIR,—When I read Mr. Cheverton's paper, in your 956th number, I found it convenient to set down the meaning of each paragraph, as regards mathematics, as concisely as I could, and I present you with the result. Each of my paragraphs refers to the one of Mr. Cheverton corresponding in number. We are told

1. That the result of a calculation will not be correct unless all the influencing circumstances of the case are taken into consideration. Many people would have believed this, even if Mr. Cheverton had not declared it true.

2. That there is no doubt whatever, that all the circumstances of all cases come "legitimately within the province of the mathematics," but, nevertheless that if even we knew all about those circumstances, we should find it "infinitely impossible" to make them the subject of calculation.

3. That, although mathematics may enable a man to unravel the intricacies of the lunar motions, or to produce some trifling affair, such as the Mécanique Céleste, it is absurd to suppose

that it will assist him in comprehending the effect of nature's laws in the working of a steam engine, or of a street grinder's wheel.

4. That mathematics may be of use to those who observe with sufficient accuracy, to enable them to distinguish a chest of drawers from a stump bedstead. And that mathematical science is useless, because some mathematicians make blunders.

5. That mathematics *may* be of some use if properly applied; from which we may fairly infer that the previous observations of Mr. Cheverton are just only when the science in question is improperly applied. This is much as if a man should condemn the use of razors, because monkeys sometimes cut their throats.

6. That pure mathematics will not enable a man to practise as a surgeon; nor even as a cow-leech.

7. This paragraph consists of nauseous laudation of practical men, who are put on a level with philosophers. It amounts to a declaration of its being more certain that a cooper can make a tub, than that a mathematician can calculate the strain on the hoops; and the writer appears to infer that therefore the cooper is superior to the mathematician.

8. Laudation continued. In a note appended, mathematics is condemned, because some person applies its language with bad taste. This shows equal candour and good sense on the part of Mr. Cheverton.

9. Mathematics is condemned, because Mr. Pilbrow is said not to make a proper use of it.

10. It is granted that mathematics can render a certain theory more perfect; "but the point of complaint is that any miserable abortion is allowed to pass, so it be concealed under a mathematical dress," or in other words, virtue ought to be condemned, because vice sometimes assumes her garb.

11. Laudation repeated. We are also enlightened by being informed that mathematics is not particularly useful, when applied to purposes which it is peculiarly unfit for.

12. In this we are gravely told, that steam engines are more likely to be improved by steam engine makers than by mathematicians.

13. This paragraph seems intended to lead us to the conclusion, that because "arts and enterprises flourish without the aid of mathematics," they flourish better without that aid than they could do with it; if not so intended, the statement amounts to a mere repetition of the cooper and the tub.

The concluding paragraph beginning "I cannot think," &c., informs us that all Mr. Cheverton meant to say of mathematics, in that which he has previously written, was just that which nobody would think of disputing, and therefore that which need not have been written at all.

I should be ashamed of the age in which I live, if I believed that so noble a science as the mathematics needed any defence; and therefore I have only endeavoured to expose the absurdity of this most uncalled for attack upon it.

Yours, &c.,

S. Y. (An Engineer.)

P. S. The machine invented by Professor Moseley, and which Mr. Cheverton is so much in love with, is an ingenious toy, perhaps, but certainly nothing better; for it is impossible to know when the machine is in motion, whether the vertical disc is driven by the outside or inside edge, or whether it slips over the surface with which it is in contact, instead of moving with it, hence, any result obtained by it is utterly useless.

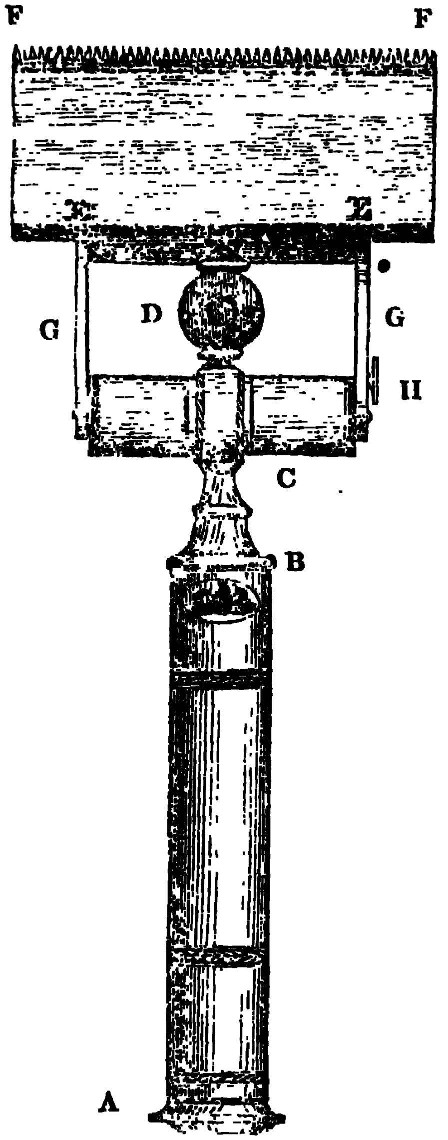
## BEDFORD'S BRIGHTON HORSE SINGER.

(Registered pursuant to Act of Parliament.)

This ingenious contrivance has been designed to obviate the inconveniences attending the use of the ordinary singeing lamps, and it appears from the concurrent testimony of all who have given it a trial, to answer fully the intented purpose.

It consists of a hollow cylindrical handle A B, and barrel C, which are filled with naptha, which flows through a passage in the cock D to the burner of the lamp E E.

F F is a toothed comb fixed to the levers G G, by a screw, and removable at pleasure, so as to admit of a plain or a toothed comb being used as occasion may require; both being supplied with




the instrument. The levers G G, are attached to the barrel C by two spindles, working in centres at each end, and are furnished with a set screw H, for holding the comb at any suitable distance from the lamp, according to the length of hair on the horse.

The wick employed in this lamp is stout flannel, of the full width of the burner, inserted double, by a piece of metal supplied for that purpose, and left projecting about half an inch beyond the edge of the lamp, and cut quite straight. This kind of wick has been found very durable, and by increasing or diminishing the quantity of its projection, the length of flame can be regulated according to circumstances. The quantity of naphtha held by this lamp is sufficient for singeing a horse all over.

Each lamp has two burners, one five inches, the other two inches wide, either of which can be screwed on to the cock D. The comb being distinct from the burner of the lamp, does not become heated, which is a great advantage, and one not afforded by any other lamp. As it is necessary at times to use the lamp without the comb, it is only required to loosen the set screw H, when the comb can be turned back upon the handle of the lamp out of the way: the lamp is filled with naphtha by removing the screw plug A, and pouring it into the barrel B.

These lamps are simple in principle, durable in construction, easy of application, and effect a great saving of time and naphtha.

In convenience to the operator, and in ease and comfort to the animal operated upon, they have been pronounced by competent judges to be greatly superior to anything of he kind hitherto produced.

## ON THE GENERATION OF SMOKE.

BY C. W. WILLIAMS, ESQ.

SIR,—Previously to continuing my observations on the evaporative Power of Boilers, I have to request your permission to lay before your readers the following correspondence, as it involves some considerations of importance to the subject, and as it will be necessary hereafter to refer to it.

I am yours, &c.,

C. W. WILLIAMS.

Liverpool, Dec. 11, 1841.

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*To Professor Brande.*

"Liverpool, Nov. 25, 1841.

"My dear Sir,—With this you will receive a copy of a printed paper on the 'Generation of Smoke,' written by me for the purpose of explaining the grounds on which I object, chemically, to the use of the term, 'the burning or combustion of smoke,' as applied by patentees to their respective plans of furnaces. This paper was intended not only as a justification of myself as regards the chemistry of combustion, and the objects and effects of my own furnace, but as a reply to the 'smoke-burning' views of others, to which I am, necessarily, opposed.

"Wishing to have your views, professionally, on the chemical part of the subject, as stated by me in this paper, I have to request your opinion on the same.

"I am, very truly, yours,

"C. W. WILLIAMS.

"To W. T. Brande, Esq., London."

*On the Combustion of Coal and the Prevention of Smoke.*

A consideration of the nature of the products into which the combustible constituents of coal are converted in passing through the furnace and flues of a boiler, will enable us to correct many of the practical errors of the day, and ascertain the amount of useful effect produced and waste incurred. These products are:

1st. Steam—highly rarefied, invisible, and incombustible.

2nd. Carbonic acid—invisible and incombustible.

3rd. Carbonic oxide—invisible, but combustible.

4th. Smoke—visible, partly combustible, and partly incombustible.

Of these, the two first are the products of perfect combustion, the latter two of imperfect combustion.

The first—steam—is formed from that portion of the hydrogen (one of the constituents of coal gas) which has combined chemically with its equivalent of oxygen from the air—in the proportion of one volume of hydrogen to half a volume of oxygen; or, in weight, as 1 is to 8.

The second—carbonic acid—is formed from that portion of the constituent, carbon, which has chemically combined with its equivalent of oxygen, in the proportion of 16 of oxygen to 6 of carbon in weight; or, in bulk, of one volume of the latter to two of the former.

The third—carbonic oxide—is formed from that portion of the carbonic acid which, being first formed in the furnace, takes up an additional portion of carbon in its passage through the ignited fuel on the bars, and is then converted from the *acid* into the *oxide* of carbon; thus changing its nature from an incombustible to a combustible. This additional weight of carbon so taken up, being exactly equal to the carbon forming the carbonic acid, necessarily requires for its combustion the same quantity of oxygen as went to the formation of the acid.

The fourth—smoke—is formed from such portions of the hydrogen and carbon of the coal gas as have not been supplied or combined with oxygen, and, consequently, have not been converted either into steam or carbonic acid.

The hydrogen so passing away is transparent and invisible; not so, however, the carbon, which, on being so separated from the hydrogen, loses its gaseous character, and returns to its natural and elementary state of a black pulverulent and finely-divided body. As such, it becomes *visible*, and this it is which gives the dark colour to smoke.

Not sufficiently attending to these details, we are apt to give too much importance to the presence of the carbon, and have hence fallen into the error of estimating the loss sustained by the blackness of the colour which the smoke assumes, without taking any note of the *invisible* combustibles, hydrogen and carbonic oxide, which accompany it. The blackest smoke is, therefore, by no means a source of the greatest loss; indeed, it may be the reverse, the quantity of invisible combustible matter it contains being a more correct measure of the loss sustained than could be indicated by mere colour.

This will be still more consistent with truth, should any of the gas (carburetted hydrogen) escape undecomposed or unconsumed, as too often is the case.

In the ordinary acceptation of the term smoke, we understand *all* the products, combustible and incombustible, which pass off by the flue and chimney. When, however, we are considering the subject scientifically, and with a view to a practical remedy against the nuisance or waste it occasions, we must distinguish between the gas as it is generated, and that which is the result of its imperfect combustion. In fact, without precise terms and reasoning, we disqualify ourselves from obtaining correct views, either of the evil or the remedy.

Now, let us look at this gas, which we are desirous of converting to the purposes of heat, under the several aspects in which it may be presented under varying degrees of temperature, or supplies of air.

In the first instance, suppose the full equivalent of air to be supplied in the proper manner to the gas, namely, by jets, for in this respect the operation is the same as if we were supplying gas to the air, as in the Argand gas lamp. In such case, one half of the oxygen absorbed goes to form steam, by its union with the hydrogen; while the other half forms carbonic acid, by its union with the carbon. Both constituents being thus supplied with their equivalent volumes of the supporter, the process would here be complete—perfect combustion would ensue, and no smoke be formed; the quantity of air employed being *ten times the volume of the gas consumed.*

Again, suppose that but one half, or any other quantity, *less* than the saturating equivalent of air were supplied. In such case, the hydrogen, whose affinity for oxygen is so superior to that of carbon, would seize on the greater part of this limited supply; while the carbon, losing its connexion with the hydrogen, and not being supplied with oxygen, would assume its original black, solid, pulverulent state, and become *true smoke.* The quantity of smoke then would

be in proportion to the deficiency of air supplied.

But smoke may be caused by an *excess* as well as a *deficiency* in the supply of air. This will be understood when we consider that there are *two* conditions requisite to effect this chemical union with oxygen, namely, a certain degree of temperature in the gas, as well as a certain quantity of air; for, unless the due temperature be maintained, the combustible will not be in a state for chemical action.

Now, let us see how the condition, as to *temperature*, may be affected by the quantity of air being in *excess*. If the gas be injudiciously supplied with air, that is, by larger quantities or larger jets than their respective equivalent number of atoms can immediately combine with, as they come into contact, a *cooling effect* is necessarily produced instead of the *generation of heat*. The result of this would be, that, although the quantity of air might be correct, the second condition, the required temperature would be sacrificed or impaired, the union with the oxygen of the air would not take place, and smoke would be formed.

Thus we perceive that the *mode* in which the air is introduced exercises an important influence on the amount of union and combustion effected, the quantity of heat developed, or of smoke produced; and, in examining the mode of administering the air, we shall discover the true cause of perfect or imperfect combustion in the furnace as we see it in the lamp. This circumstance, then, as regards the manner in which air is introduced to the gas, (like the introduction of gas to the air,) demands especial notice, as the most important, although most neglected, feature in the furnace, and in which practical engineers are least instructed by those who have undertaken the task of teaching them.

But let us trace the several stages or circumstances which lead to combustion in the furnace. These are—

1st. Expelling the bituminous constituents from the coal, in the form of gas; that is, converting them from the solid to the gaseous state. This is effected by their *absorption* of heat.

2nd. Decomposing this gas, (carburetted hydrogen,) and resolving it into its constituents, hydrogen and carbon; thus preparing each for union with its respective quantity of oxygen, according to its own specific law and measure of affinity. This is effected by further *absorption* of heat.

3rd. Raising these two combustibles to the temperature respectively required for chemical and electrical action. This also is effected by a still further *absorption* of heat.

I may here stop to observe, that this is the stage of the process at which light is given out, and which is almost exclusively attributable to the radiation from the ignited and minutely-divided carbon, the atoms of which are then at the highest possible temperature: a temperature, as Sir Humphrey Davy observes, beyond the white heat of metals. If, however, these elementary atoms of carbon be not supplied with oxygen at this juncture, they are quickly carried away by the current, (improperly termed the draught,) and their own diminished specific gravity, and, soon losing the required degree of temperature, become unfitted for chemical action, and form the *black* matter of smoke and soot.

4th. Producing atomic contact (technically called diffusion) between the oxygen of the air and the atoms of hydrogen and carbon thus liberated from that union which had before constituted them an hydro-carbon gas.

5th. Affecting the chemical union of those bodies, or so many of their elementary atoms as have obtained contact with their respective equivalents of oxygen, and in as rapid succession as such contact may be obtained. *This latter process alone is combustion, all the preceding ones being merely preparatory*. This is the process in which the respective electricities of the combining elements are exchanged, when heat is developed, and when new and distinct bodies are chemically formed.

We perceive throughout the whole of these several stages that the combustibles, in their progress towards combustion, are uniformly *absorbing* heat, the last stage alone being that in which new heat is generated, and which, in its turn, is to impart the required temperature to other atoms as they successively enter on a similar course. We see, also, that the interruption of the progression at any one stage involves the escape either of the compound gas or its elementary atoms, and their conversion into smoke.

We see, then, how palpably erroneous is the idea, that smoke, once formed, can be consumed in the furnace in which it is generated, and how irreconcilable is such a result with the operations of nature. The formation of smoke, in fact, arises out of the failure of some of the processes *preparatory* to combustion, or the absence of some one of the conditions which are essential to that consummation from which light and heat are obtained. To expect, then, that smoke, which is the very result of a deficient supply of heat, or air, or both, can be consumed in the furnace in which such deficient supply has occurred, is a manifest absurdity, seeing that, if such heat and air had been supplied, this smoke would not have existed.

*Opinion of W. T. Brande, Esq., Professor of Chemistry at the Royal Institution, London, on the preceding Paper.*

Royal Mint, 29th Nov., 1841.

Dear Sir,—I quite agree with you as to the distinction which ought always to be made and observed between the "prevention of the formation of smoke," and the "combustion of smoke after it has been made;" and also, as to the necessity of accurately defining what is meant by the term "smoke."

I have carefully perused the printed extract of your lecture on these subjects, delivered at the Victoria Gallery, Manchester, and am ready to admit the general correctness of the chemical principles upon which your views are founded. The *colour* of the smoke is, as you properly observe, no criterion of the loss of combustible matter, or of the waste incurred by any particular form of combustion.

Carbonic oxide, carburetted hydrogen, and various hydro-carbons, in the form of *vapour*, may escape, and often do escape, *invisibly*, from the chimney; and, as they are all combustible, are, strictly speaking, so much loss of fuel. Steam is also an invisible product of combustion, and a constant ingredient of smoke.

Your system of throwing jets of air into the inflammable gases and vapours which constitute so large a part of the matters which, in many ill-constructed fire-places and furnaces, escape by the chimney along with the finely divided carbon, or *black smoke*, renders them all available as sources of heat; and where that system is perfectly applied, the *smoke* can consist of very little else than carbonic acid, steam, and nitrogen; all *incombustible*, and also incapable of *supporting* combustion. Yours, my dear Sir, very faithfully,

William Thomas Brande.

C. W. Williams, Esq., Liverpool.

## WOODEN TYRE WHEELS.

Sir,—In your Magazine of the 6th of November, I see wooden tyre wheels brought forward as a complete failure. It is stated that a pair made at the house in which Mr. Dircks was a partner, had been tried on the Liverpool and Manchester Railway, and S. S. says he sends the information to you as being due to you and the public. Now, sir, I beg leave to send you my remarks on the subject, for the same reason which influenced S. S., namely, that they are due to you and the public. Sir, you know that I was the first who proposed wood tyre for wheels, as being proper for railways, but I wish to say that the plan of making them, which I laid before the public, has not been acted upon; and this I believe to be the cause they have not answered. You know that, in the model wheel which I sent you, I proposed to make the *wood* fast in a very different way to the plan adopted by Mr. Dirks. I have had many thoughts on the durability of wood, from observing the wood used for stone-mason's mallets, and never thought of harder wood being used than what is used for that purpose. Teak-wood is not proper, being too hard and brittle, and I have no doubt this is one of the causes of failure; another cause is, that there was not a screw bolt through each piece of wood able to compress the piece to a very considerable degree; I believe the softer the wood the better, so that it be tough. It will be no interest to me to make a pair at my expense, but I have not yet changed my mind on the subject. I believe I could make a pair that would stand cannon balls shot at the *wood*. I believe, too, that wheels might be made upon this plan for common stone-paved roads.

Sir, you once said you should wish to have justice done to me in this matter; if you will have the goodness to publish this, it will be only acting up to that promise.

I remain, sir,
Your obedient servant,
William Frost.

Derby, December 4, 1841.

## THAMES AND CLYDE STEAMERS—PLAN OF AN ENGINEER'S LOG-BOOK, RECOMMENDED FOR THE ADOPTION OF THE ROYAL MAIL STEAM PACKET COMPANY.

Sir,—After writing a reply to "Vulcan's" letter contained in your No. 951, I hesitated about sending it to you, being of opinion that the subscribers to your truly useful publication must be quite tired of the subject. Your remark (No. 954) strengthened that opinion, nor should I have troubled you with it now, had not "A. M.," in his last letter (No. 957) imperatively called on me to trespass once more on the attention of your readers. The following is a copy of the letter which I intended sending you on the 2nd of November, and for which I must now earnestly solicit a place.

Sir, — I presume your correspondent "Vulcan," by his letter in your last number (951), professes to give a correct account of the performance of the *Wallace* and *Burns* Clyde-built steamers. Now as he has furnished me materials wherewith to prove the contrary, I feel myself bound to reply. He first states that the *Wallace* had 30 tons of coals on board (10 tons being in the after-hold) but that these coals were not put in to trim the *Wallace*, as I have stated, but only to give the *Duchess of Kent* a fair chance. If the *Wallace* was in proper trim before those 10 tons were put in her after-hold, she must have been most woefully out of trim after the coals were put there, and I will leave your readers to judge whether it is at all likely, that the vessel being about to try her speed with another boat, the parties interested in her would not have more equally distributed the weight, *if it was weight only that was wanting*. Again, with respect to his statement as to the *Wallace* having to slacken her speed to allow the *Duchess* to pass, the fact was this: the *Wallace* did manage to keep a-head for a considerable distance from Blackwall, by what is commonly termed "jockeying," till at last, the commander of the *Duchess*, losing his temper, would have run her right ashore, had she not eased and got out of his way. But your correspondent admits that the *Duke of Sussex* beat the *Wallace* five minutes to Blackwall: such being the case, how can he make out that the *Wallace* beat the *Duchess of Kent*, the latter being considerably faster than the *Duke of Sussex*?

Your correspondent says there has been nothing said about the *Burns*. The fact is, she was not worth notice in the Thames. I know nothing of her performances at Southampton. The subject under discussion has been the comparative merits of Thames (not Southampton) and Clyde-built steamers. However, I am of opinion enough has been said on the subject at present; for neither the *Duke*, *Duchess*, *Wallace*, nor *Burns* are worth writing about at the present day.

I am, &c.,

L. P.

November 2, 1841."

As I wish to bring this subject to a close, you will perhaps allow me to reply to A. M.'s last, who asks, "Why I cannot mention decidedly the pressure the *Railway* carries?" I stated, in No. 917, that she does not work to more than 7 lbs. on the square inch in the boilers.

However, as I am (in common with many others) anxious that the relative merits of London and country built engines should be put fairly before the public, and as an opportunity now offers, which may not occur again for many years, I venture to point out a plan which would settle the question beyond all possible doubt.

The Royal Mail Steam Packet Company are just about to start several of their new boats. Now, I propose that the engineer-in-chief of each vessel should be required to keep a log-book, and that at the end of every voyage a correct copy of it should be made, and published in some respectable periodical, (certainly none more fit for the purpose than the *Mechanics' Magazine*.) And with your permission, Mr. Editor, I would suggest that the returns should be made every four hours, which is the time, I believe, determined on for each watch in the engine-rooms of these vessels; and that the log-book should be of the form shown on the following page.

It is necessary for me to observe, that I propose the log-book to be of such dimensions as would allow the Indicator diagrams being put in the space allotted to them, just as they are taken from the instrument; and that the diagrams should not be less than 8 inches by 4 inches.

I need not, I am sure, point out the great advantages which the Company would obtain by this, or some other mode of reporting the performance of their engines. It may suffice to cite the Cornish practice as an example.

Trusting, Mr. Editor, that your views of this subject coincide with mine, and that they will have the advantage of your able advocacy,

I am, Sir,

Your very obedient servant,

L. P.

[The plan suggested by our correspondent, for ascertaining the comparative performances of the different vessels of the Royal Mail Steam Packet Company—including, as they do, specimens of both English and Scotch workmanship, and from some of the best workshops of both countries—is an excellent one, and we earnestly hope it may find favour in the sight of those with whom it rests to have it carried into execution. Should it be adopted, it will give us great pleasure to have our columns made the medium of giving publicity to the results.—ED. *M. M.*]

| Date. | Engines built by Messrs. | | | Diameter of Cylinders, inches. Length of Stroke, feet. | Vessels built by Messrs. | Length of Perpendiculars ...... Breadth of Beam ...... Area of Midship Section at Average Draught of Water ...... | | Feet. |
|---|---|---|---|---|---|---|---|---|
| | Average Number of Revolutions. | Coals consumed in lbs. | Tallow used in lbs. | Oil used, in Pints. | Copies of Diagrams taken by Indicator from each Cylinder. Starboard. | Copies of Diagrams taken by Indicator from each Cylinder. Larboard. | Average Knots per Hour. | Name of Engineers on Duty. |
| 1st Watch, from 12 P.M. to 4 A.M. | | | | | | | | Chief |
| | | | | | | | | 1st |
| | | | | | | | | 2nd |
| 2nd Watch, from 4 A.M. to 8 A.M. | | | | | | | | Chief |
| | | | | | | | | 1st |
| | | | | | | | | 2nd |
| 3rd Watch, from 8 A.M. to 12 A.M. | | | | | | | | Chief |
| | | | | | | | | 1st |
| | | | | | | | | 2nd |
| 4th Watch, from 12 A.M. to 4 P.M. | | | | | | | | Chief |
| | | | | | | | | 1st |
| | | | | | | | | 2nd |
| 5th Watch, from 4 P.M. to 8 P.M. | | | | | | | | Chief |
| | | | | | | | | 1st |
| | | | | | | | | 2nd |
| 6th Watch, from 8 P.M. to 12 P.M. | | | | | | | | Chief |
| | | | | | | | | 1st |
| | | | | | | | | 2nd |

## VINDICATION OF THE SERVICES RENDERED BY SCOTLAND TO STEAM NAVIGATION.

Sir,—Being a constant reader of your valuable Magazine, I observed in your October part the concluding strictures on Mr. Russell's Treatise on Steam Navigation, and am of opinion that the writer of them, in censuring Mr. Russell's neglect of the English engineers, has gone to the opposite extreme, and done considerable injustice to the Scotch. Considering Mr. Russell quite competent to defend himself, if necessary, I shall not enter into the merits of his work; but confine myself to the statement of a few facts, which, as I hope they will correct some errors now prevalent, you, as a lover of truth, must be happy to insert in your Magazine.

In the first place, the reviewer introduces Mr. Boyman's table of the rise of steam navigation, and its progress in Great Britain, from 1788 to 1838; desiring by it to prove that England has done more for the extension of steam navigation than Scotland. Certainly, it does show that more steam vessels have been made in the former; but this is only what was to have been expected from the relative position, population, resources, and extent of the sister countries. The same table, however, shows, that if England has built more than her northern neighbour, the latter led the way; for, from 1788 to 1813, the first six steam vessels were built in Scotland, and during that time not one did our friends across the Tweed construct. From that time till now, the operation of the above-mentioned causes has produced the effects to be expected. Now the question is this, which did the most for steam navigation—the one which led the way, or the other, that followed in the wake?

In the second place, the reviewer admits that Mr. David Napier first ran steam vessels to the adjacent coasts of Ireland, France, and Holland. This, he must allow, was establishing intercourse between Britain and the continent of Europe, and evidently paving the way for what has been accomplished since. Moreover, the first British steam vessel that crossed the Atlantic was the *Sirius*, the engines of which were made at Glasgow, by Mr. Wingate.

It is hardly fair to call Mr. David Napier to account for the accidents which may have taken place in steam-boats fitted out with his engines; many of these he is no more answerable for than the engineers of the *President* are for her loss.

Besides, the writer seems to claim for the Messrs. Seaward the credit of having first applied to steam vessels engines having a direct connexion between the piston and the crank; there is no denying that they first introduced them into the *Gorgon;* but they are by no means the first who applied them to steam-boats. Strange as it may seem, there is in the *Alert*, (one of our oldest Clyde steam-tugs,) an engine made on the same principle, at least twenty years ago, by Mr. M'Arthur, of Glasgow, a sketch of which I take the liberty of enclosing. Nor is this all: in the *Tourist* there was another of the same construction, made in Leith. If there is any borrowing, therefore, in the case, the English have copied from the Scotch.

With regard to the consumption of fuel, I should like to see the Admiralty reports referred to by the reviewer; and, to be able to contrast it with the relative speed of the different government vessels. I should also like to know something about the addition made to the nominal power, as almost every engineer has a different mode of calculating the power. It is impossible, at present, to say what this addition really is; so that the only criterion by which to judge is, the diameter of cylinder, and the length and number of strokes.

Although Mr. Robert Napier should construct engines on the plan introduced into the navy by the Messrs. Seaward, it is no proof that he prefers that plan. Had it been an atmospheric engine, instead, no doubt he would have made it in the ordinary course of business, however little he might approve of the plan.

As to the engines of the *Great Western* being the master-piece of "marine enginery," they may be considered such by the English engineers, but the Scotch have a very different opinion of them; for though their power is better proportioned to the size of the vessel, and consequently the vessel sails faster, yet they have not stood the test which the *British Queen's* have.

It is only the desire that the abovementioned facts should be placed in an unprejudiced light, which has induced me to trespass so much on your patience. I am, Sir,

Your obedient servant,

HECTOR M. S. GRANT.

Glasgow, November 16, 1841.

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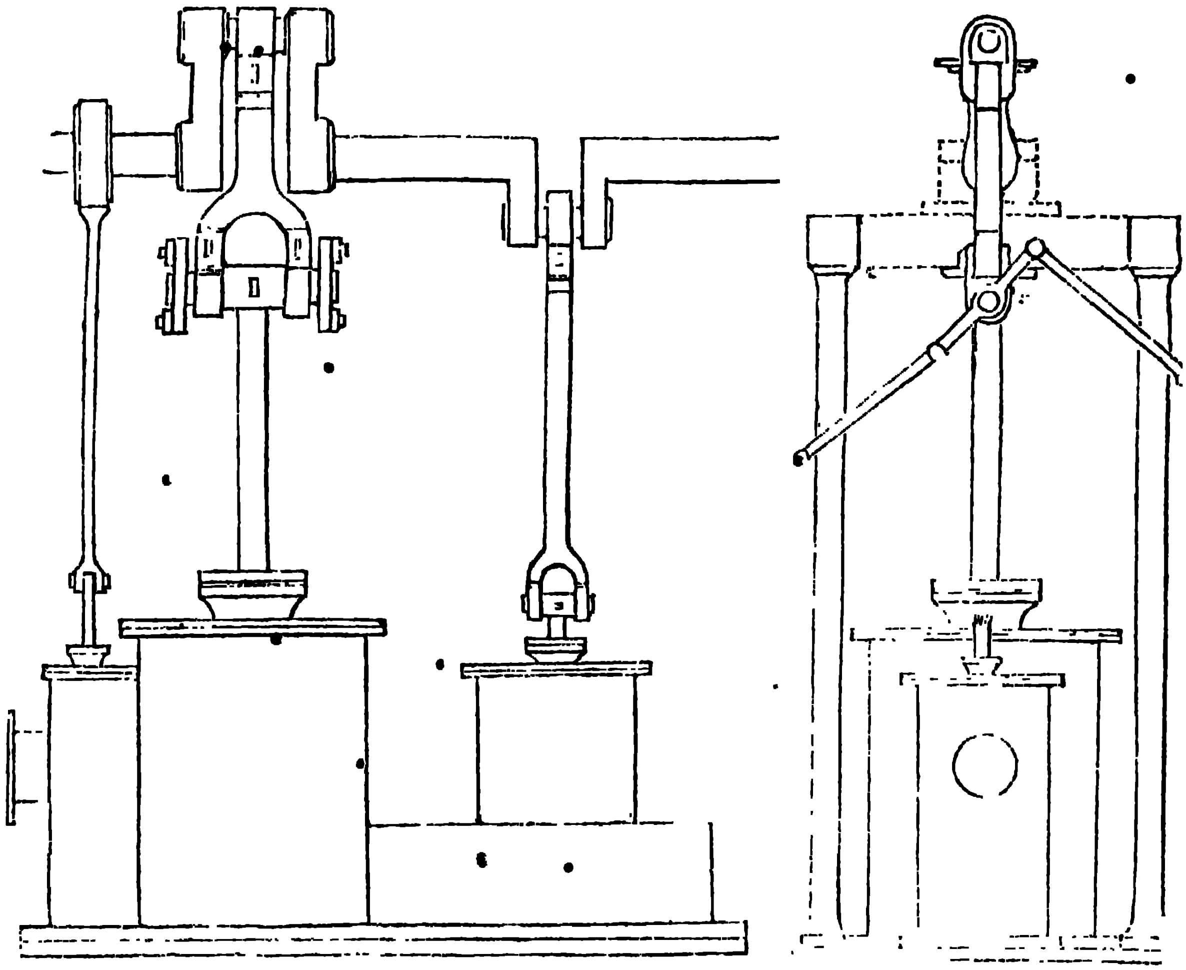
We subjoin the sketch which Mr. Grant has sent us of the engines of the *Alert* steamer.



The only point of resemblance between these engines and those of the *Gorgon*, (the only one, indeed, for which our correspondent contends,) consists in the connecting-rod leading direct to the crank. In all other respects—the arrangement of the parallel motion, the mode of working the air-pump, and the construction of the slide-valves more especially—they are essentially different. But *the direct action*—is not that something to boast of? No doubt it is. The *Alert*, however, is by no means the best ancient instance of the sort which Scotland has furnished. The engines of the *Tourist*, to which our correspondent alludes, as being also on the direct plan, were of a much superior description to those of the *Alert*. She was fitted by Mr. Gutzmer, of Leith, and is familiar to our recollection as having been for several years engaged in the London and Leith trade. May we ask, however, wherefore it has come to pass, that the Scotch engineers, after thus adopting the direct action, should have so universally abandoned it? How has it happened, that, for the twenty years preceding 1840, (when the *Gorgon* engines first made their appearance,) the engine-makers north of the Tweed should have produced only beam engines, differing in nothing, except in excess of weight, from the models furnished by Boulton and Watt, in the earliest days of steam navigation? Why was the very *Tourist*, of which we have been speaking, when

sold to the General Steam Navigation Company about seven years ago, stripped of her direct acting engines, and refitted with new engines on the beam principle? Was the cause any other than this—that though the Scotch engineers early appreciated the superiority of the direct action, they were wanting in the skill necessary to carry out that principle into beneficial operation, and that it was on that account alone they abandoned it? Is it not a fact, that the engines of the *Tourist*, though arranged with great ingenuity, were so defective in all their details, and of such inferior workmanship, that they could never be worked up to within 30 per cent. of their cylinder power; and had, almost every season, to undergo most extensive and costly repairs? Be these circumstances as they may, this at least is certain, that until the Messrs. Seaward showed the way, in 1810, to a proper and beneficial use of the direct action, it had for nearly an entire generation been lost sight of, by the Scotch engineers as well as by all the world besides. It is idle, and most uncandid, to boot, to say, that Mr. Napier is now making engines for the Royal Navy, on the *Gorgon* plan, to *order merely*, in the same way as he would do any other piece of work "in the ordinary course of business, *however little he might approve of the plan.*" The true history of the affair is simply this, that, the Lords of the Admiralty have too much good sense to think of any longer encumbering their men of war with engines on the beam principle, weighing 310 tons, when they can have engines of the same power on the Gorgon plan, weighing only 260 tons, and occupying one fourth less space; and that Mr. Napier is too much a man of the world not to see the prudence of a prompt conformity with the march of improvement in his own particular line of business. The Admiralty advertised for tenders for engines on the Gorgon plan, (or what amounts to the same thing, made known by circulars, their desire to have such tenders sent in,) and Mr. Napier *having nothing better to offer to the notice of their lordships*, made a tender for one which was accepted. Messrs. Maudslays and Field have met the new state of things with rather more sagacity and talent than Mr. Napier; for when they saw that the fate of the beam engine was sealed, by the introduction of the Gorgon system of construction, they forthwith invented their double cylinder engine, which offers such a parity of advantage with the Gorgon, as enables them, without copying after any one, still to maintain their ground as engine makers, of first-rate capability and resources.

What we have said as to the fate of the beam engine may seem at variance with the fact, that most if not all of the engines made and making, for the Royal Mail Steam Packet Company are on this plan. But it is really not so. The operations of that Company have been attended with peculiar circumstances, (to which it is unnecessary to advert here, more particularly) which have obliged them to have recourse to what was easiest to be had, rather than to what would have suited their purposes best. The vessels of this Company, although, among the most recently constructed in Great Britain, are by no means to be regarded as among the best which this country is at the present time capable of producing.—Ed. M. M.]

## REMARKS ON THE REVIEW OF MR. RUSSELL'S WORK ON STEAM NAVIGATION —IN REFERENCE MORE PARTICULARLY TO THE CLAIMS OF MR. DAVID NAPIER.

Sir,—On reading your article on Mr. Scott Russell's Work on Steam Navigation, in which I take a warm interest, I think you do justice to the memory of the late Mr. Symington, when you point out the active part he took in its introduction, but in the next page you deprive him of a portion of his merit, when you say that "we are indebted to Messrs. Boulton and Watt for the arrangement generally adopted in Marine Steam Engines, which was introduced by these gentlemen in the year 1819." If I am not mistaken, Mr. Symington took out a patent for that very arrangement nearly twenty years before that period. One thing I am certain of, is, that all the steamers extant, with scarcely one exception, previous to 1819, which comprehends a period of seven years after their practical introduction into this country by Mr. Bell, had engines of the construction which is at

present generally used, that is, with an equally poised beam on each side of the cylinder.

In another part of your article, you admit that Mr. Russell, "not unjustly awards great praise to Mr. David Napier for being the first to attempt the navigation of the open sea by steam," "although you are not aware that he contributed any thing towards that end." I believe that Mr. D. Napier was the first to connect the steam engine direct to the paddle-shaft, and to introduce the simple paddle-board at present in general use. Previously to his time, gearing intervened between the engine and the paddle-shaft, which was liable to derangement at sea, and the paddles were wholly of iron. It was to these, and other minor simplifications of the machine, as well as the general adaptation of the vessel and machinery to sea-going purposes that his first success is to be ascribed. And this to a certain extent is corroborated by the following facts. Prior to the year 1818, various attempts had been made to navigate the open sea with steam-boats. The most remarkable of these were two vessels that were built for the express purpose of carrying the mails between Holyhead and Howth, the most important ferry in the British Empire. No expense was spared in their construction, and the engines were made by Mr. Cook, Engineer of Glasgow, then the most celebrated engine maker in Scotland, who had made the engines of the most successful steamers at that time. After two years of persevering efforts on the Holyhead station with these packets, they were laid aside, and the idea of navigating so rough a passage with machinery of any kind was set down as impracticable. After the successful experiments of the *Rob Roy** on the Belfast station, Mr. Napier constructed the *Talbot* and *Ivanhoe*† for the Holyhead station, the success of which induced Government to send commissioners to Glasgow to purchase these vessels, for which they offered 5,000*l.* premium in addition to their value. That offer being rejected, government employed Messrs. Boulton and Watt to construct two powerful steamers for that passage service. The *Meteor* and *Lightning* in due course made their appearance, which were warmly opposed by the *Talbot* and *Ivanhoe*; in that contest, the government, with the view of driving off their competitors, lowered the passage money; nevertheless, the opposition was kept up, until the government packets, breaking down frequently, they were obliged to charter the *Talbot* to carry the mail, and latterly purchased the *Ivanhoe*. Mr. Napier having by this time placed a better packet on the Belfast station, the *Rob Roy* was sent to ply between Calais and Dover, where she continued unmolested till government again employed Messrs. Boulton and Watt to make two steamers for that station, the *Dasher* and *Arrow*. Although nearly double the power of the *Rob Roy*, they were successfully opposed, single-handed by that vessel, and invariably beaten, especially in stormy weather,—a circumstance which induced the French government to buy up the *Rob Roy* for the purpose of carrying the French mail, being the first steamer owned by that government.

In another part of the same article, you draw attention to the improved construction of the Gorgon engines. Although the best construction of engines extant for marine purposes, is certainly a thing capable of mathematical demonstration, I believe it will long continue a disputable point; I will therefore leave that to persons more competent to the task to discuss; but as the engines of the *Gorgon* have been prominently alluded to, I would ask in what respect they differ from those of the *United Kingdom*, and several others made nearly twenty years ago? The only material difference I can perceive is, that the engines of the *Gorgon* have a shorter connecting-rod and the beams for working the air-pump are rocking and more elevated.

All parties must agree with you as to the great taste displayed in the London-made engines, particularly those made by the Messrs. Penn.

I am, Sir, your obedient servant,

AN AMATEUR.

London, Nov. 11, 1841.

[After the earnest part we have taken in vindicating the title of William Sym-

* "The *Rob Roy*, in the year 1818, was the first vessel that proved the practicability of navigating the open sea by steam."

† "The *Talbot* and *Ivanhoe* on the Holyhead station, and the *Belfast, Eclipse, Superb* and *Majestic*, on the Greenock and Liverpool passage, were the first sea-going steamers that completely succeeded." See 5th Report of the Select Committee of the House of Commons on Steam Boats.

The whole of the above were made, and I think were principally owned by Mr. David Napier.

ington to be regarded as the sole and exclusive originator of steam navigation, no one will suspect us of any inclination to deprive him of a single particle of credit to which he is rightfully entitled. The claim now set up for him, however, to the invention of the Boulton and Watt arrangement is new to us, and accompanied as it is with a qualifying "if I am not mistaken," we may be excused if we ask for some further evidence of its truth before we admit that we have been guilty of the injustice to Symington's memory which our correspondent imputes to us. We cannot at present conveniently refer to the specification of the patent taken out by Symington, in order to see how the matter really stands; but perhaps our correspondent may have it in his power to furnish us with a copy, or at least with an extract of so much of it, as he relies upon for corroboration of his statement. One or other he must feel it incumbent upon him to produce.

Leaving the facts stated by our correspondent to make their own impression, in favour of Mr. Napier's claim to a higher rank among steam-engine improvers than we have ourselves seen cause to assign to him, we cannot allow his (affected) disparagement of the merits of the Gorgon engines to pass without a word or two of remark. "Amateur," cannot, forsooth, discover in what these engines differ from those of the old *United Kingdom!* He could not possibly have made a more unfortunate comparison. The *United Kingdom* is notorious (on the Thames at least,) for the bad proportions, worse workmanship, and general inefficiency of her engines. Before the lapse of eleven years from her first equipment, during which time, we are credibly informed, she was so frequently laid up for needful repairs, that she was not at work more than three years altogether, the engines were taken out and sold for old iron, and the vessel herself converted into a floating coal depôt. Among the particulars in which the engines of this abortion of a steamer differed from the *Gorgon,* it may suffice to notice one or two of the more important. The power of the *United Kingdom* engines was transmitted by means of two cross rods, four side rods, and one connecting rod; while the power of the *Gorgon* engines is conveyed direct from the piston rod to the crank, by means of *only one connecting rod.* Again, the *United Kingdom* engines had packed slide valves of a most cumbrous construction, which were rarely steam-tight, and required at least half a dozen men to work them; while the *Gorgon* are fitted with the admirable slide valves (invented and patented by Mr. S. Seaward,) which require no packing, never leak, and can be worked with the utmost ease by a couple of hands. Ground for comparison, in short, there is none. Had our marine steam engine building advanced no farther than where the *United Kingdom* found and left it, its condition at the present day would have been a fitter theme for reproach and ridicule, than (as it justly is) for exultation and pride. ED. M. M.]

## EXPERIMENTS ON STEAM-ENGINE POWER. BY JOHN BAYNES, ESQ., OF PARK-PLACE WORKS, BLACKBURN.

Many and various are the rules given to calculate the power of steam-engines. I will briefly enumerate a few.

*Permanent force of a horse.*

Desaguliers reckons that a horse will walk at the rate of 2½ miles per hour, or 220 feet per minute, against a resistance of 200 lbs. A horse power will therefore be equivalent to raising (200 × 220) 44,000 lbs. 1 foot high per minute, when working 8 hours a day.

Mr. Watt, from repeated experiments, makes it 150 lbs. at the rate of 220 feet per minute, (150 × 220) = 33,000 lbs. 1 foot high per minute. His steam-engines were calculated to work at the rate of 44,000 lbs. per horse power, but he allowed only 33,000, considering the difference due to loss by friction.

Tredgold reckons a horse power at 27,500 lbs. when continued 8 hours a day, or 33,000 lbs. when continued 6 hours a day.

*Loss of power, (according to Tredgold.)*

If the pressure of the steam on the boiler be 1,000, there is a loss,

1. By the force required to produce motion of the steam in the cylinder . . . ·007
2. By the cooling in the cylinder and pipes . . . ·016

3. By friction of the piston, and loss . . . . . . ·125
4. By the force required to expel the steam through the passages . . . . . . ·007
4. By the force required to open and close the valves, raise the injection water, and overcome the friction of the axes . . . . . . . . ·063
6. By the steam being cut off before the end of the stroke . . . . . . . . ·100
7. By the power required to work the air-pump . . ·050
——— ·368
———
Leaving effective or available power ·632
———

And to determine the mean effective pressure, when the force of the steam in the boiler is different from that of the atmosphere, multiply the given pressure in inches of mercury by ·632, and from the product subtract the pressure due to the temperature of the uncondensed steam; the remainder is the pressure required in inches of mercury. Multiply this pressure by $14\frac{3}{4}$ lbs., the atmospheric pressure on a square inch, and divide the product by 30; the quotient is the mean effective pressure on a square inch of the piston; which, multiplied by ·7854, gives the pressure on a circular inch.

As before stated, the loss is ·368 of one atmosphere: hence, the effective pressure is ·632 of this pressure. Consequently, the mean effective pressure on the piston, when the force of the steam in the boiler is different from that of the atmosphere, is found by the preceding rule.

The force of low pressure steam in the boiler is generally equivalent to that of 35 inches of mercury, the temperature being 220°, and the temperature of the uncondensed steam 120°, its force being equivalent to that of 3·7 inches. Hence we have 35 inches × ·632 = 22·12 inches − 3·7 inches = 18·42 inches. Whence $18·42 \times 14\frac{3}{4}$ lbs. = 271·7 ÷ 30 = 9·056 lbs. per square inch × ·7854 = 7·1 lbs. per circular inch for mean effective pressure.

*To find the power of a steam-engine.*

Multiply the mean effective pressure on the piston by the square of its diameter in inches, and by the velocity of the piston in feet per minute; the product is the effective power in pounds raised one foot high per minute; this divided by 33,000 gives the horses' power.

The following approximate methods are most commonly used, viz.:—

The steam in the boiler is supposed to be at a constant pressure of about 3·18 lbs. per square inch, or $2\frac{1}{2}$ lbs. per circular inch, and the piston at a constant or uniform velocity of 220 feet per minute; and the effective force on the piston about $7\frac{1}{2}$ lbs. per square inch, or 5·89 lbs. per circular inch, and under such circumstances 30 circular inches are considered equivalent to 1 horse power, when the beam for connecting motion from the piston is 3, and the connecting-rod not less than $2\frac{1}{2}$ times the length of the stroke.

Marine engines being more confined, and the connecting-rods being seldom more than from $1\frac{3}{4}$ to twice the length of the stroke, as a compensation for this disadvantage, the area of the piston is augmented to $31\frac{1}{2}$ circular inches per horse power.—(Mr. Templeton.)

In Lancashire, the engineers' standard of a mechanical horse power is 25 square inches area of piston at a velocity of 220 feet per minute.

An analysis of many engines which are working well gives 1 horse power equivalent to

| | | | | | | |
|---|---|---|---|---|---|---|
| 25 square inches area, piston | 220 | feet per minute; | or |
| $31\frac{1}{4}$ circular | „ | „ | 220 | „ | „ | or |
| 23 square inches area, piston | 240 | „ | „ | or |
| 29 circular | „ | „ | 240 | „ | „ | |

A favourite velocity of the piston, amongst some of the first-rate engineers is, for a

| | | | | | | |
|---|---|---|---|---|---|---|
| 7 feet stroke, | 17 | strokes per minute | | = 238 | feet velocity. |
| 6 „ | 20 | „ | „ | = 240 | „ |
| $5\frac{1}{2}$ „ | 22 | „ | „ | = 242 | „ |
| 5 „ | 24 | „ | „ | = 240 | „ |

Reckoning the mechanical horse power at 25 square inches area, with a velocity of 220 feet of the piston; or 23 square inches area, with a velocity of 240 feet; good modern engines ought to indicate nearly double their mechanical power when fully loaded.

*To estimate the power of a steam-engine by the Indicator.*

Find the square inches area of the cylinder, which multiply by the average pressure indicated, and that multiplied by the velocity of the piston per minute gives the momentum, which divided by 33,000 lbs. and $\frac{7}{10}$ of this will equal the effective power, (horses.)

Engineers reckon 10 lbs. for average pressure, but only 7 lbs. for effective power; allowing 3 lbs. to be consumed by the engine itself. Or, the power may be found thus: multiply the square inches area by the velocity of the piston per minute, and this product by the average pressure; divide by 44000, (200 lbs. × 220 ft.) the quotient will be the horses' power (effective.) This gives a rather higher result than the preceding rule, which is thus accounted for. In the former case, ·3 of the whole is taken off, for power consumed by the engine itself; in the latter case, only ¼th, (44000 − 33000 = 11000,) is allowed for power consumed by the engine itself; which will make the latter result (3 − ·25) = $\frac{1}{20}$th greater than the former. This, I am inclined to think, is nearest the truth, as in my experiments I find the average loss of power, in good modern steam-engines, with all the mill gearing and shafting, on the best principle, attached to them, as in a cotton factory, to be only $\frac{3}{11}$ths of the whole power, or half-way between ·3 and ·25; so that we may safely say that a good engine will only consume ¼th of the whole power.

The following experiments were made with M'Naught's Steam-engine Indicator, upon cotton-mills of the latest construction, having steam-engines fitted up on the most approved principles.

(1.) Engine 7 ft. stroke, 17 strokes, cylinder 37½ inches bore, called 50 horse power, driving 22060 hand mule spindles, with preparation, besides 260 looms and common sizing; indicated 16·73 lbs. average pressure.

37½ × 37½ × ·7854 × 16·73 lbs. × 7 ft. stroke doubled × 17 strokes ÷ 33000 131 horses' power, with all the weight on. Friction of the engine and shafting indicated 4¾ lbs. 37½ × 37½ × ·7854 × 4¾ lbs. × 7 ft. doubled × 17 strokes ÷ 33000 = 38 I. P.

| | | | |
|---|---|---|---|
| The whole power . . . . . . . . | 131 horses | | |
| Friction of engine and shafting . . | 38 | = ditto | = ·283 |
| Nett or available power . . | 96 | = ditto | = ·717 |

(2.) Engine called a 40-horse; cylinder, 32¼ inches bore; 6 ft. stroke, 20 strokes per minute; driving 15220 hand-mule spindles, with preparation, and 330 looms with common sizing; indicated 18·95 lbs. average pressure.

32¼ × 32¼ × ·7854 = 818 square inches area, × 6 ft. stroke doubled, × 20 strokes × 18·95 lbs. ÷ 33000 = 103 horses' power, gross. Friction of engines and shafting, 4·53 lbs. pressure, or 28 horses' power.

| | | |
|---|---|---|
| Whole power . . . . . . . . . | 118 horses. | |
| Friction of engines and shafting . . | 28 ditto | = ¼ |
| Nett or available power | 90 | = ¾ |

To give the result of all the experiments, in full, would take up too much time and space. I have therefore condensed them into the following table. (See next page.)

The result of these experiments gives to each mechanical horse power
600 hand-mule spindles, with preparation; or,
450 self-acting do. do.; or,
200 throstle spindles do.; or,
20 looms with sizing.

## COMPARATIVE VIEW OF THE WORK PERFORMED BY DIFFERENT ENGINES.

*November*, 1841.

| Numbers. | Bore of Cylinder. | Length of Stroke. | Number of Strokes. | Velocity of Piston per minute. | Mechanical Horses' Power, calculated to the standard of 25 square inches area and 220 feet. | Machinery. | | | | Remarks. | Indicated Power. | | | | | Proportion. | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Hand-mule Spindles. | Self-acting Spindles. | Common Throstle Spindles. | Looms. | | Average Pressure. | Total Power. | Average Pressure. | Engines and Shafting. | Nett, or Available Power. | Friction of Engine and Shafting. | Machinery. | |
| | inches | feet. | | feet. | | | | | | | lbs. | | lbs. | | | | | |
| 1 | 33¾ | 6 | 20 | 210 | 39 | 4000 | | 4000 | 200 | Common Sizing. | 13·46 | 90 | | 24½ | 65½ | ·273 | ·727 | Chapman's expansive gearing. |
| 2 | 42¼ | 7 | 20 | 280 | 71 | 23340 | | | 666 | Common Sizing. | 16·64 | 200 | 5· | 60 | 140 | ·300 | ·700 | Plenty of cold water. |
| 3<br>4 | 38 1/16<br>38⅜ | 7<br>7 | 20¼<br>20½ | 290½<br>290⅔ | 60<br>60 } | | 20000 | 5400 | 800 | Patent Sizing. | 13·47<br>15·9 | 135<br>163 } | 7·6 | 76 | 222 | ·250 | ·750 | Coupled at right angles. |
| 5 | 37½ | 7 | 17 | 238 | 48 | 22060 | | | 260 } | } Common Sizing. | 16·73 | 134 | 4·75 | 38 | 96 | ·283 | ·717 } | } Plenty of cold water. |
| 6 | 32⅞ | 6 | 20 | 240 | 37 | 15220 | | | 330 } | | 18·95 | 118 | 4·53 | 28 | 90 | ·250 | ·750 } | |
| 7 | 27 | 3 | 35 | 210 | 22 | | | | 430 } | | 15·6 | 57 | 4·51 | 17 | 40 | ·300 | ·700 } | |
| 8 | 39 | 6 | 21 | 252 | 55 | 31100 | | | | | 15·16 | 138 | | 38 | 100 | ·273 | ·727 | |
| 9 | 39¼ | [illegible] | 16½ | 231 | 51 | 4500 | 6620 | 3750 | | | 11·45 | 123 | | 41 | 82 | ·333 | ·666 | Heavy gearing & short of water. |
| 10 | 37 | 6 | 21 | 252 | 49 | | | | 1000 | Patent Sizing. | 18·25 | 146 | | 44 | 102 | ·300 | ·700 | All water to lift for condensing. |
| Total | | | | | 492 | 100520 | 26620 | 13180 | 3686 | | | 1304 | | 366⅓ | 937½ | ·28 | ·72 | |

The sixth column is calculated to the standard of a mechanical horse power, viz., 25 square inches area of cylinder, piston 220 feet per minute.

The result of the above experiments gives ·28 or $\frac{3}{11}$ as the power consumed by the engine and shafting, leaving ·72 or $\frac{8}{11}$ for machinery. 492 mechanical horses = 937½ indicated, or nearly double.

Each indicated horse power will drive—

305 hand-mule spindles, with preparation; or,
230 self-acting do. do.; or,
104 throstle spindles do.; or,
$10\frac{1}{2}$ looms with common sizing.

Including preparation:

1 throstle spindle = 3 hand-mule, or $2\frac{1}{4}$ self-acting spindles;
1 self-acting spindle = $1\frac{1}{3}$ hand-mule spindles.

Exclusive of preparation, taking only the spindle:

1 throstle spindle = $3\frac{1}{2}$ hand-mule, or $2\frac{5}{8}$ self-acting spindles;
1 self-acting = $1\frac{2}{3}$ hand-mule spindles.

In one-horse power each:

| | | | | | |
|---|---|---|---|---|---|
| Proportion of carding | ·32 | Proportion of carding | ·3 | Proportion of carding | $\frac{1}{7}$ |
| Do. hand spinning | ·68 | Do. self-acting spinning | ·7 | Throstle spinning | $\frac{6}{7}$ |
| | 1· | | 1· | | 1· |

JOHN BAYNES.

Blackburn, Park-place Works,
December 11, 1841.

## A FEW REMARKS ON ELECTRO-METALLURGY.—BY MR. T. B. JORDAN.

(From the Transactions of the Royal Cornwall Polytechnic Society.—Eighth Annual Report.)

In the course of a limited series of experiments, which I have tried in this interesting branch of the useful application of electricity, a few ideas have occurred to me, which I believe, possess the charm of novelty. As no suggestion, however trivial in itself, can be considered altogether unimportant, when it bears on the practical application of science to our manufacturing arts, I feel no hesitation in laying before the Society the following remarks with a view to their being made public. It is quite evident that Mr. Spencer's recent discovery, of the art of depositing metals from a solution of their salts by galvanic action, has placed in the hands of manufacturers a new means of copying, and the importance of this will be immediately apparent to those, who know how large a portion of our manufactures in metal are the copies of original matrixes, or more indirectly the results of other copying processes. Some imagine that because it is only the means of copying it is really of little value; but it is impossible to allow this to be a valid objection, when we consider how very few metal articles there are, which do not wholly or in part owe their origin to copying. If then it can be shown that this method possesses advantages for some description of work, which are not common to any other, and that there is good reason to suppose it may be economically conducted, then we may fairly infer, that it will in due time become one of the ordinary processes of our factories.

Its advantages are numerous, and some of them so self-evident that they only require naming to be allowed; for instance, any surface, whatever be its material or form, may be covered with a coating of metal, without heat and without force; this coating may be allowed to accumulate to the required thickness, and may then be removed from its original, when the surfaces which were in contact, will be found to be so perfectly alike that it is impossible to discover the minutest scratch in one, which has not its counterpart in the other. In proof of the accuracy of the copy, I may refer to the numerous admirable copies of engraved plates and medals already before the public; if any of these specimens be examined with a glass, it will be found that not only every line of the graver, but every scratch in the polished surface of the original plate, is faithfully transferred, both to the deposited matrix, and the subsequent copy of it; and when we consider the fact that both these copies are of the same material as the original plate, and that that may just as well have been of a much softer and more workable material, we must immediately conclude that there is no other known mode of copying, possessing like advantages. But as the application of it to the copying of engravings, medals, woodcuts, and similar subjects, is already well known, I merely refer to it in illustration of my views, and will now offer a few reasons for supposing that it may eventually be found an economical process, for some of the more ordinary branches of our manufactures in metal.

I can now only explain the principles which lead me to imagine that it would not be a costly process on the large scale. In my preliminary experiments, I have used Mr. Smee's battery of platinated silver and zinc, excited by diluted sulphuric acid; it acts well and is more convenient than the sulphate of copper batteries.

Mr. Spencer's very simple and cheap arrangements, in which the negative plate of a single pair is that receiving the deposit, is I think very suitable for flat work, but for complicated forms, I should certainly prefer having the battery arrangement, separate from the depositing cell, both on account of its being more manageable, and because in this way the solution of the sulphate of copper is kept constantly at the point of saturation by the destruction of a portion of the copper plate connected with the negative plate of the battery; of course the solution of this plate is effected by the portion of acid set free by depositing its copper on the mould, assisted by the galvanic action, so that in fact this method gives us the power of removing the material from any old and irregular piece of metal, and depositing it in the most highly wrought mould of which we may wish to obtain a copy.

In taking a comparative view of the probable cost of production, it will not be necessary to consider the first outlay for apparatus and moulds, because there must be a much larger outlay before commencing operations in the usual way; and leaving this out of the question, the cost of any electro-deposit would be made up of the value of the raw material, of the zinc and acid used in the battery, and of the time employed in making the arrangement.

The raw material may be obtained in considerable quantities, at its lowest price, as old sheathing copper would be admirably adapted to the purpose, on account of the facility with which it may be bent to any required form. The zinc and acid used in the battery would only have combined to form sulphate of zinc, which would be of some value. The time required for making the arrangements in the different troughs of a large factory, would be comparatively small, because one man may keep a great number at work, as they only require attention once in twenty four hours—of course there must be many other persons employed in such a factory, in preparing new patterns, and new battery plates and connections, but these come under other heads of expenditure which have their counterparts in the present mode.

I will now suggest a few of the plans which may be used for producing hollow vessels. The most simple process which has occurred to me, and the one which I have already used with success, is to form a block of some easily fused material into the shape of the interior of the required vessel, which serves as the matrix for depositing the copper on; when this is sufficiently thick, it may be placed on the fire till the block is melted, when the fluid material may be poured from any of its openings, and leave the hollow vessel complete and in a single piece, without the aid of the soldering iron or hammer. The temporary block on which this vessel is deposited may be formed of wax, cement, fusible metal, lead, or any other convenient material which melts at a much lower temperature than the metal to be deposited. I consider this method to be peculiarly applicable to the most complicated forms of metallic musical instruments, and to crooked tubular work generally; but it has certainly the great disadvantage of requiring a new mould for every repetition of the work, *or rather a new block*, for these may in many cases be cast in a mould which would be permanent for any number of repetitions. There is however one means of avoiding this in some cases, which is very well illustrated by the common *boot-tree*; if this were put together, and after having its surface metallized, placed in the depositing trough for a proper time, we should certainly have it covered with copper, we may then take out the centre or key piece, which would unlock the others and they may readily be removed, leaving a copper boot—not a very desirable article certainly, but the block may just as well have been formed to a more suitable shape. Still there are disadvantages in this mode of procedure which would limit the application to a few articles, although there are some which could not readily be accomplished in any other way. For the production of ornamental vases and other works of value, I would suggest the following method: Let the whole, or a segment of the work, according to the nature of the design, be moulded in wax, carved in wood, cast in plaster, or produced in any more convenient way, then metallize the surface, and deposit on as large a portion of the original as will relieve in one piece, repeat this at different times over the whole work, and so manage the edges of each piece that the whole shall key together in the usual way, so that when finished you will possess a metallic mould for the required work. Should the design be complicated in form, a number of pieces will be requisite; but there are many very expensive articles which would readily relieve if the mould were in a single piece, and a very much more extensive class which may be made in two parts. Of course the inside of these metallic segments would correspond in polish and finish to the original model, and the metal mould, when complete, would serve for an unlimited number of copies, which would not require any cleaning up or hand finishing, but the parts would require to be put together, which I propose to effect by the same power that produced them; this, I think, may be done by covering the work with wax varnish while warm, and afterwards carefully cleaning all the edges, and

then binding it together as if for soldering: the joints must now be touched over with nitric acid, and the article properly connected with the battery, and placed in the depositing trough; copper will immediately begin to deposit on the joints, and in a few hours, I imagine, that these joints would be quite as strong as any other part; if so, the method would have the decided advantage of joining the work with pure copper, and of doing this without exposing any part of it to the fire. I have not yet attempted to join any work in this way, but I consider that I have good evidence of its practicability, in the well-known fact of deposited copper uniting with any other portion of copper which has been cleaned with nitric acid, quite as intimately as the different parts of the original piece are united.

In the foregoing remarks, I have endeavoured to show, that the system of Electro Metallic deposits is capable of producing every article which leaves the workshop of the copper-smith, and that there is no very apparent reason for supposing that it would be too costly to compete with the usual processes of manufacture; still, much of this opinion is speculative, and as yet I have not sufficient experimental evidence to offer in support of it, but such as I have, has fully satisfied me that it is correct. The small toy which accompanied this paper was made a few days before the meeting, and I believe it is the first symmetrical copper vessel ever produced by galvanic action.

NOTE.—The specimen of an electrotype copy of an engraving, which accompanies this Report, was executed by Mr. Jordan at the Museum of Economic Geology, where an extended series of researches on this subject are being carried on, of which it is one of the first fruits. Through the kind application of Mr. Jordan, the conductors of this valuable national establishment have consented to the presentation of the electrotype matrix and plate to the Polytechnic Society, and it will form a very interesting part of the Museum of Manufactures.

## ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

*** *Patentees wishing for more full abstracts of their Specifications than the present regulations of the Registration Offices will admit of our giving, are requested to favour us with the loan of their Specifications for that purpose.*

JOSEPH WOODS, LATE OF LAWN-PLACE, LAMBETH, BUT NOW OF THE VULCAN FOUNDRY, NEAR WARRINGTON, LANCASHIRE, CIVIL ENGINEER, *for certain improvements in locomotive engines, and also certain improvements in machinery for the production of rotary motion, for obtaining mechanical power; which improvements in machinery are also applicable for raising or impelling fluids.*— Petty Bag Office, November 22, 1841.

The first improvement in locomotive engines consists in using loose wheels, so as to admit of their traversing round curves more easily than at present. For this purpose, one of each pair of wheels is keyed or otherwise fastened to its axle in the usual way, but the opposite wheel is allowed to turn freely on the axle.

The second improvement consists in a new mode of lubricating the axle bearings. Underneath the end of the axle is a small roller partially immersed in oil, which, being turned round by contact with the axle, continually carries up and distributes a supply of oil as it revolves.

The third improvement is in the reversing gear of locomotives, and consists in making one reversing shaft act simultaneously upon both eccentric rods and forks, and throw them in or out of gear with the weigh-bar pin. For this purpose, the reversing shaft has two arms, fixed angularly to each other, the ends of which are connected by links with the forked extremities of the eccentric rods.

The fourth improvement consists in connecting a whistle with the blast-pipe, or to one end of a cylinder, so as to give a constant intermittent whistle when travelling through a fog, or when any obstruction arises to the usual speed of the engine.

The fifth improvement consists of a peculiar arrangement and construction of the swivel joints of the pipes which convey the water from the tender to the engine.

The sixth improvement consists of a new arrangement of the parts of rotary disc engines; the principal peculiarity of which lies in the forming of steam passages through the centre ball of the diaphragm; the construction is too complicated however to be explained without the aid of drawings.

WILLIAM LEWIS RHAM, OF WINKFIELD, BERKS, *for certain improvements in machinery or apparatus for preparing land, and sowing or depositing grain, seeds, and manure.*— Petty Bag Office, November 25, 1841.

This apparatus consists of a rectangular iron frame, mounted on four wheels, the axle of the hinder wheels giving motion to the several working parts. In front of the machine are a number of angular pressers, which form a series of furrows in the ground for the dibbles which follow them. Behind the dibbles are a similar number of hoppers containing the seed, and behind these again a series of larger hoppers, filled with manure. The lower end of each hopper is contracted and furnished with a tumbler valve, which is a cylinder with a recess in it of sufficient capacity to receive the quantity of seed or manure

to be delivered at each movement. The lower part of each spout is enclosed in a moveable shield connected to the tumbler valve by a connecting rod and crank; these shields are connected by rods to the shanks of the dibbles, and are drawn forward by their motion, so as to close the aperture at the bottom of each spout at the same time. The dibbles and two series of hoppers are so arranged and connected as to act simultaneously, and are placed at such a distance from each other, that whilst the dibbles are making one row of holes, the seed is being deposited in the previous row, and the manure is being discharged over the seed the third row. The hoppers are followed by a row of forked rakes which draw the earth over the seed and manure that have been deposited, and by a roller which levels and consolidates the ground.

JOSEPH GIBBS, OF THE OVAL, KENNINGTON, CIVIL ENGINEER, *for certain improvements in roads and railways, and in the means of propelling carriages thereon.* — Enrolment Office, December 4, 1841.

These improvements are nine in number.

The first, consists in constructing the bridges or viaducts which may be required in the formation of roads and railways, partly in the manner of the ordinary arc-bridges, and partly in the manner of the suspension bridge, so as to combine in one structure the advantages of both systems of construction, without any abutments being required to resist the thrust of the arched bridge, or any land ties to hold the suspension chains in their place.

The second improvement consists in a method of making common roads and that description of railways called tramways, of wooden blocks, laid and combined in such a manner, that every block shall receive a support from each of those adjoining to it. This, is effected by means of "key-pieces," which may be made of wood, or of wrought or cast-iron, (the latter being preferred,) let into horizontal cuts or grooves made for the purpose in all the angles of each block; so that when the blocks and key-pieces are fitted to each other, the whole will form one solid mass. In cases where great solidity is required, the patentee proposes to cover the foundation of the road with thin sheets of iron, previously coated with zinc, or other anti-corrosive material, and then lay the blocks of wood on these sheets, whereby the material composing the foundation of the road is prevented from rising between the blocks.

The third improvement, relating to the propulsion of carriages on railways, is fully illustrated at the head of our present number.

The fourth improvement consists of another mode of propelling carriages upon railways, by means of stationary engines.

To the piston of the engine is attached, by a cross-head, two arms or levers which are fixed to one end of a horizontal shaft; upon the other end of this shaft is fixed a vibrating lever at right angles to the former levers; to the end of the vibrating lever is attached an iron rod, called a vibrating rod, of any convenient length, and to it, at suitable intervals, are also attached any convenient number of parallel levers turning upon axles. At each extremity of the vibrating rod is attached (by a chain which passes over fixed wheels, or drums to keep the vibrating rod always stretched in a straight line) a counterbalance weight. There is also a frame attached to the carriages, which carries three axles; upon the first axle, are two wheels which run upon the same rails as the carriage; upon the second, is a lever running loose upon its axle, which has at one end a wheel or roller, that runs upon the vibrating rod, and at the other end a pall acting upon the teeth of a ratchet wheel, and also running loose on the same axle. Fixed to the ratchet wheel is a toothed wheel, which takes into a pinion upon the third axle, and gives motion to another toothed wheel, which takes into another pinion fixed upon the second axle, and which latter gives motion to the driving wheels.

A slow motion being given by the steam engine to the system of levers connected with it, they communicate motion to the vibrating rod, causing it to ascend and descend each time. This vibrating rod acting against the roller at one end of the loose lever, lifts up the one end and depresses the other to which the pall is attached; the pall acting upon the teeth of the ratchet wheel moves it round together with the toothed wheel with which it is connected, and thus, through the system of wheels and pinions, motion is communicated to the driving wheels of the carriage, with a degree of velocity proportionate to the ratios of the wheels and pinions.

The fifth improvement consists in propelling carriages on railways by the following contrivance:—near the centre and through the whole length of a railway a pair of sliding bars of wood or iron (wood being preferred) are properly mounted upon friction rollers, or on vertical vibrating levers, kept on the stretch by counterbalance weights attached to their ends. These bars are actuated in the same manner by the lever as before described, except that one is always travelling in a contrary direction to the other. On these vibrating bars are placed a pair of propelling rollers attached to toothed wheels, which take into a pinion on the axle of the driving wheels of the carriage. These rollers turn loose upon their axles, and have ratchet teeth within them which are taken hold of by a pall secured to the axle. By this means the

roller slips, whilst the bar is being drawn backwards in a contrary way to that in which the carriages travel, but when the bar proceeds in the direction which the carriages travel, the pall then takes hold of the ratchet teeth and communicates motion through the wheel and pinion to the driving wheel.

The sixth improvement consists of another modification of means for propelling carriages on railways :—a steam cylinder is placed in the line of rails, but below them, which causes the stroke of the steam-engine to actuate the vibratory bars without the intervention of levers and shafts. In this case no crank is needful, and the length of the stroke of the piston may be proportioned to the length of the vibration of the bar.

The seventh improvement relates to the running of carriages on common roads. Trackways of blocks of stone are laid down as now practised, except that the joints are to be laid askew to give a smoother motion to the carriage wheels. Between the blocks a continuous longitudinal piece of wood is laid, the upper edges of which are chamfered or bevelled off. On this longitudinal piece of timber a guide-wheel runs, touching only the chamfered edges; the guide-wheel has a flange on each side, but the flanges do not touch the sides of the timber. This guide-wheel traversing along the timber keeps the carriage wheels upon the blocks.

The eighth improvement consists in another mode of propelling carriages on railways and tram roads :—in the centre of the road, bars of wood are properly jointed or connected together, so as to form one continuous bar the whole length of the road. This continuous bar, which is called a propelling bar, is placed upon springs, which force it upwards. A pilot carriage is first moved over the road by horses, or other suitable power at a slow rate, in the centre of which carriage and connected with it, is a roller, the weight of which must be proportioned to the resilient force of the springs under the propelling bar, so that it may be able to depress that bar on passing over it. As soon as the bar is depressed, it is firmly clutched and held down by iron claspers, until it is required to give off the power in the springs. A propelling roller is placed at the end of the carriage, of sufficient weight to propel the carriages; this roller bears only upon the propelling bar, which, as before mentioned, is held down by the claspers, until set free by the disengaging apparatus: when the propelling bar rises behind the roller and acts as a lever, continually urging the carriage forward. By this means a slow motion may be converted into a quick one, free from the disadvantages usually attending high velocities.

The ninth and last improvement consists in the following method of propelling carriages upon railways. A railway is formed of longitudinal and transverse sleepers, with rails of any approved form. Upon some of the transverse sleepers at convenient distances, are fixed bearings for friction wheels or drums in pairs, which support a wooden cylindrical shaft of any length that may be required. Attached to one or both ends of a carriage is a wheel, the surface of which is in contact obliquely with the surface of the wooden shaft, and, consequently has its axis oblique to the axis of the shaft. A slow motion being given to the shaft, by any approved means, and thereby communicated to the wheel, the carriage will be propelled with a great velocity, which may be increased or diminished, according to the angle at which the wheel is set to the shaft, and to the proportion that the diameter of the said wheel and shafts bear to each other.

George Bent Ollivant, and Adam Howard, of Manchester, Millwrights, *for certain improvements in cylindrical printing machinery, for printing calicoes and other fabrics, and in the apparatus connected therewith, which is also applicable to other useful purposes.*—Enrolment Office, December 5, 1841.

These improvements consist, firstly, in arranging the printing cylinders over each other, with a separate bowl to each.

Secondly, in driving the four printing cylinders by two vertical shafts, one at each end of the machine. On each shaft are two bevel wheels which take into bevel wheels on each pair of cylinders.

There is a clutch-box at the bottom of each shaft to enable each set of cylinders to be used independently of the other, and two pieces of cloth to be printed at once.

Thirdly, in different modes of putting on and relieving the nip or pinch of the printing cylinders, either simultaneously or separately.

Fourthly, in the application of a "pitch-bar," suspended from a horizontal axis, to the cylinders.

Fifthly, in the employment of differential driving gearing, which is applicable to all kinds of machinery requiring a variable speed.

This gearing is composed of two shafts, carrying two sets of differently proportioned cog-wheels which take into each other; each pair of wheels being thrown in or out of gear by a tappet-rod which slides in a groove formed in one of the shafts.

Sixthly, in an apparatus in which the printed pieces of cloth are dried, by passing them over a series of steam chests, or ordinary drying cylinders.

John Mee, of Leicester, Frame-smith, *for improvements in the manufacture*

*of looped fabrics.*—Enrolment Office, December 5, 1841.

The first improvement consists in adapting warp machinery to a stocking frame, for producing ornamental patterns of warp fabric, by using two or or more sets of threads, which are capable of being brought into action at different times.

The second improvement consists in combining warp machinery with a stocking frame, for the purpose of producing ornamented fabrics and platted work, on the face of the stocking fabric, as well as in the fabric which is produced by the warp machinery. The arrangements are in each case, however, unintelligible without the illustrative drawings, which accompany the specification.

JAMES COLLEY MARCH, OF BARNSTAPLE, DEVON, SURGEON, *for certain improved means of producing heat from the combustion of certain kinds of fuel.*—Enrolment Office, December 8, 1841.

These improved means consist in impelling a sufficient quantity of atmospheric air in streams downward, upon the surface of the coals in furnaces, instead of allowing it to ascend through fire bars in the ordinary way.

This principle is first shown as applied to a stationary boiler; beneath the boiler instead of the ordinary fire place, there is a deep cavity filled with coals, called the coal chest, its bottom being a plate furnished with two toothed racks and guide-bars, so as to be raised to the top of the cavity as the fuel is consumed. This plate is furnished on each side with hinged flaps, which lie close against the sides of the cavity, and prevent the coals from escaping. In order to guard against the jamming of the coals, the cavity or coal chest is made a trifle larger at top than at bottom; a difference of one inch each way being said to be sufficient for a coal chest four feet deep. A main pipe connected with a revolving fan, or other suitable blower passes in at the front of the boiler, through the bottom of which short tubes project downwards, which direct the streams of air upon the surface of the fuel. The furnace is lighted by placing live coals, or chips, shavings, &c., on the top of the fuel and passing a moderate stream of air down upon it, when the surface becomes perfectly ignited all over in about five minutes; and the stream of air being increased, perfect and smokeless combustion goes on at the surface of the coals. As the fuel is consumed, it is raised by a couple of wheels and pinions, which work in the racks of the plate upon which the coals are supported.

The same principle is shown with such modifications as are necessary to adapt it to locomotive and to marine steam boilers; in the former case the fan is placed within the water space of the tender, and driven by a belt from one of the running wheels; the coals are raised by two screws, one right handed, the other left, worked by cogged wheels, placed beneath the coal chest.

The patentee states, that, 975 cubic feet of atmospheric air, are required in this furnace, to evaporate one cubic foot of water. The jet tubes from which the air is driven upon the burning fuel, vary from three quarters of an inch, to one inch and a quarter. Sixteen tubes one inch in diameter, evaporated 20 cubic feet of water per hour. The tubes are found to be most advantageously disposed, when placed at intervals of about nine inches from each other. The patentee excepts anthracite coal from the fuels adapted to this method of combustion, and proposes, when a strong flame is required, to introduce some combustible fluid (as coal tar) with the streams of air. The fuel immediately beneath each jet burns into a hollow, which is to be levelled, and any clinkers that may form to be removed, by an iron hook, through a door provided for that purpose.

The fuel is not to be used in pieces larger than an orange, and is to be mixed with small coal to fill up the interstices.

The claim is to the mode of obtaining combustion of fuel by causing streams of air to be blown, and caused to impinge on the upper surface of such fuel, without passing through the general body of coal below the ignited surface.

HENRY RICHARDSON FANSHAW, THE YOUNGER, LATE OF JOINVILLE-LE-PONT, IN THE KINGDOM OF FRANCE, BUT NOW OF HATFIELD-STREET, CHRISTCHURCH, SURREY, CHEMIST, *for improvements in curing hides and skins, and in tanning, washing, and cleaning hides, skins, and other matters.*—Enrolment Office, December 10, 1841.

This patentee states, that tannin matter when once penetrated into hides or skins, is quickly taken up and the liquor reduced in strength, and that it is desirable to remove such weakened liquor to allow fresh portions of stronger liquor to be introduced into the pores of the hides or skins, and deposit fresh quantities of tannin. That he is aware that several plans have been proposed, and patents taken out for methods of driving the liquor into the hides by hydrostatic and other pressures, and that, although the present patentee uses pressure for like purposes, he does not claim the same, excepting when brought into action in some one or other of the modes hereinafter described. And that his invention has for its object certain means of constructing and working machines, whereby hides and skins are alternately submitted

to tannin liquor to absorb the same, and then by pressure to remove the weakened or spent liquor, that the hides or skins under process may again be in the most favourable state for imbibing fresh portions of tannin.

In the first machine the skins are laid flat one above the other, and fine bark dusted between them; in some cases, cords are passed through the four corners of the skins, which are kept separate by knots or washers of wood, &c.; the cords are attached to the four corners of a large plate or plunger, which is moved up and down by a couple of rods worked by eccentrics, or other suitable mechanism.

When the plunger is raised the skins are separated and freely imbibe the tannin liquor in which they are immersed, and which on the plunger being depressed again, is squeezed out, a fresh portion being imbibed on its next ascent, and so on till the process is complete. In another form of the machine the plunger is placed below the skins and presses them up against a fixed bed or table placed above them.

A second machine described as applicable to this purpose is very similar to a rolling mill; it consists of a circular pit containing tannin liquor, in which the hides or skins are laid. Two rollers of wood or other suitable material are mounted on a shaft, which passes across the pit, and is supported in its centre. The axles of the shaft have each two spiral grooves around their circumference, and on the rollers there is a projecting pin working in the same, so that on the shaft being turned, the rollers travel round the pit, moving at the same time from and towards the centre, and rolling over every portion of the hides in a spiral direction, press or squeeze out the liquor from the hides which imbibe a fresh portion as soon as liberated from the pressure of the rollers.

A third apparatus consist of a large outer cylinder of wood, around the inner circumference of which the hides or skins are fastened by wires, tapes, &c., being introduced through doors provided for that purpose, which are afterwards closed. Within this cylinder is placed a large roller cylinder which rests upon the hides at the bottom of the outer cylinder, and is retained in its place by the side plates of the former, in which there are a number of slits or openings all round, for the free ingress and egress of the tannin liquor, in which the apparatus is either wholly or partially immersed. Motion being given to the outer cylinder from any convenient source, the hides are carried down under the roller, by which the liquor is squeezed out, and a fresh portion afterward imbibed. This arrangement may be reversed, and the roller made to press against the top of the cylinder if preferred.

In the fourth plan, the hides are fastened around a large revolving cylinder, either wholly or partially immersed in liquor. An endless band of felt cloth, or canvass coated with india rubber, passes down under this cylinder and up over a roller placed above it; on motion being given to the roller, the cylinder is carried round and the hides at its lower circumference subjected to the squeezing of the endless band; or the endless band is dispensed with, and a roller is made to press on the upper or lower portion of the revolving cylinder.

The liquor may in either case be kept at any approved temperature by pipes, through which hot water or steam is passed. By using water instead of tannin liquor, any of the foregoing apparatus may be used for washing and cleansing hides, skins, &c. The claim is, 1. To the mode of subjecting hides and skins alternately to be pressed and relieved from pressure, by means of a plunger as described. 2. To the mode of subjecting hides and skins alternately to pressure and relief from pressure, by rolling surfaces which also traverse from and to the centre of the machine as described. 3. To the mode of applying hides or skins, inside or outside of a revolving cylinder or frame, and subjecting them to pressure by rolling surfaces or endless bands as described.

The "improvements" of this patentee differ in nothing essential from those patented two or three years ago by Messrs. Herapath and Co., and now in use in a great many tanneries in England and Scotland.

GEORGE CLAUDIUS ASH, OF BROAD-STREET, GOLDEN-SQUARE, DENTIST, *for improvements in apparatus for fastening candles in candlesticks.*—Enrolment Office, December 11, 1841.

This apparatus consists of a double wedge or filling piece of metal, which is composed of two convex plates or limbs, having a tendency to remain at a certain distance apart, and when applied to holding a candle in a candlestick, the one limb abutting against the candle, and the other against the interior of the socket, effects the required holding. These filling pieces are shown as constructed in various ways, in some cases plates and springs, and in another instance wire only being used. The patentee states, that he is "aware that it has been proposed to construct candlesticks with what may be called spring holders or sockets for candles, in connection with and forming part of a candlestick. I do not, therefore, claim the retaining candles in candlesticks by means of spring instruments generally, but do confine my claim of invention to the mode of fastening candles in candlesticks, by applying elastic metallic wedges or filling pieces, which being separate from the candlestick, may be used with different candlesticks."

NOTICES OF RECENT AMERICAN PATENTS.

[Selected and abridged from the *Franklin Journal.*]

Steam Engines. *New arrangement for preventing the Dead Point in the Crank. C. F. Ferris.* "What I claim," says the patentee, "as my invention, is the manner in which I have arranged and combined the horizontal and vertical cylinders, that is to say, I claim placing said cylinders (whether one be horizontal, and the other vertical, or otherwise, providing their relation to each other be still the same,) at right angles, or nearly so, with their closed ends adjoining each other, and the crank, or mean shaft between them, at the junction of the angle, and operating the cranks by means of having the connecting-rods of both cylinders attached to them."

The placing two steam cylinders, with their axes at right angles, has been heretofore done, and with the same object in view as that above stated; but the novelty, in the present instance, consists in the placing the two closed ends, or what usually constitutes their bottoms, close to each other, with the crank shaft so situated as to occupy the space between said closed ends. From the crank, or rather cranks, connecting rods extend to the pistons of each cylinder, in the ordinary way. By this arrangement a great part of the room is saved, which was uselessly occupied by the connecting and operating parts, on the former plans of placing the two cylinders; and so far, certainly, this may be considered as an improvement.

Improved Water-Wheel, *Joseph Hanchett.* This wheel is a modification of the well known paddle wheel, in which the paddles are always kept vertical, by an eccentric guide wheel, or disk, at the side of the main wheel, the axis of each paddle having a crank, which works in the eccentric guide wheel, so that as the main and guide wheels revolve together the paddles enter and leave the water vertically, instead of radially. That which the patentee claims as an improvement consists of a method of changing the relative position of the main and guide wheels, so as to make the paddles enter and leave the water at a given inclination; and this is effected by having the shaft of the main wheel suspended in stirrups attached to two short shafts, on one of which the guide wheel works; on the end of these shafts are the levers, which change the position of the stirrups, and consequently the main wheel, relatively to the guide wheel. The line of the paddles will always be parallel with the line passing through the centre of the guide and main wheels. This, we suppose, will be just as good as some of the numerous analogous contrivances which have been made the subjects of patents, but none of which has yet superseded the ordinary wheel, or even placed it in jeopardy.

Improvements in the Universal Chuck; *Simon Fairman.* The chuck which is the subject of these improvements is of the kind in which the holders, or pieces, which confine the articles to be turned, are moved simultaneously towards, or from, the centre of the chuck, by means of a convolute groove on a plate at the back. The first improvement is in the mode of uniting the front and back plates by means of a tube which projects from the back of the front plate, and unites it to the back plate, the two being held together by a nut which screws on to the end of the tube. The inside of the tube is provided with a female screw to screw on to the mandrel. Whilst the chuck is on the mandrel the nut may be loosened, which will allow of the revolving of the back plate, on which is the convolute groove, to work the holders. The second improvement is in making openings in the outer rim attached to the front plate, through which that part of the holders which slides in the plate may pass, so that that part of the holders may be made long for a steady bearing, and be allowed to pass out through those holes in the rim, when any thing of great diameter is to be turned.

Improvements in the Rotary Fan Blower; *James Stewart.* This improvement consists simply in using two, or more, fan wheels on the same shaft, each contained in a separate chamber; the current generated by the first wheel is received into the second chamber, and passes through the second, third, and so on, if more than two are used. Dr. Jones states, that he has seen this machine in operation in blowing a smith's forge, and that its action was such as to bespeak real utility.

Improved Dredging Machine; *Wm. Easby.* This machine is intended to be worked by horses, that travel on a circular platform, built on the deck of a large scow. The whole machine is made narrow enough to pass through a canal lock, and in order to make the platform on which the horses travel, of sufficient size, a segment of the circle, called a wing, is hinged on each side to the scow, so that in passing through a canal lock, or any other narrow place, the wings may be

turned up. The scoop is to be worked by two barrels, or drums, placed one at the top, and the other at the bottom, of a vertical shaft, in the middle of the platform—these drums are, alternately, thrown in and out of gear by means of a vertical sliding bolt, and a horizontal lever, worked by the attendant. The chain that draws up the scoop passes round a roller at the end of the machine, and thence around the barrel at the top of the shaft, and that which draws it down and back, passes under the platform, and winds on the lower barrel.

The scoop is attached by one of its sides to two long guide poles, that slide in loops made in two collars, turning loosely on the ends of a horizontal windlass, which forms the axis around which the scoop swings, when drawn up or let down. In letting down the scoop, the chain which is attached to its bottom is drawn in by throwing the lower barrel into gear; this causes the guide poles of the scoop to slide in the loops, which brings it near to the windlass, and after it has passed a vertical line its gravity causes it to sink. The lower barrel is then thrown out of, and the upper into, gear; by this the scoop is drawn along the bottom, and filled, and then, with its load, is drawn up out of water. The stuff raised is discharged from it into a scow, or other receptacle, by pulling a rope, or chain, which disengages a spring catch, by which the hinged bottom is fastened. The bottom is closed as the scoop strikes the water, in the operation of being drawn down to be re-filled. The distance to which the scoop descends below the windlass, around which it works, is regulated by a chain, which winds around it, and is attached to a brace connecting the two guide poles together, near the scoop.

**Improvement in the Franklin Cooking Stove,** *R. B. Houghton*. The back plate of the fire-place in this stove, instead of running up, as usual, rises only a few inches, and just above the upper edge of it a square shaft extends from side to side of the stove, and passing through one of the side plates is provided with a winch by which to turn it round—from one of the sides of this shaft grate bars project, and from a contiguous side, a flat plate extends at right angles to the grate bars. Between the back plate of the fire-place and the front plate of the oven, there is another plate, extending nearly as high as the top of the oven, with a flue between it and the oven; and the side plate of the stove is provided with an opening, and door to correspond to the space between it and the back plate. By this arrangement the fire may be situated nearer to, or further from, the oven. When the shaft is so turned as that the grate bars lie horizontally, the fire is sustained on the grate, and the dead plate stands at right angles thereto, and forms the back of the fire-place; and when it is turned, so as to have the grate bars vertical, the plate lies horizontally, and it, together with the grate and the second back plate, constitute a box stove, which is supplied with fuel through the door at the side. Two valves are used to regulate and give proper direction to the draft. The claim is limited to the combination of the "turning grate" with the vertical plate and dampers.

## NOTES AND NOTICES.

*Sir John Herschel.*—A recent number of the *Philosophical Magazine* contains the following interesting account of the awarding of the Royal Medal to this distinguished astronomer, at the meeting of the Royal Society:—The Royal Medal, which the Council had proposed to give to the most important paper in Astronomy, communicated to the Royal Society within the last three years, is awarded to Sir John Frederick William Herschel, for his Catalogue of Nebulæ and Clusters of Stars, published in the *Philosophical Transactions* for 1833. In delivering this medal, the President addressed the Society as follows:—"This, gentlemen, is the second time that a royal medal has been adjudged to Sir John Herschel, for researches in a department of astronomy which has descended to him as an hereditary possession; and I believe I may venture to say, that in no case has a noble inheritance been more carefully cultivated, or more enriched by new acquisitions. The catalogue for which the royal medal is now given, contains a list of 2,500 nebulæ and clustres of stars, the same number which had been observed and catalogued by his father, though only 2,000 of them are common to both catalogues; the right ascensions and declinations of all these objects are determined; the general character of their appearance recorded; and all those which present any very extraordinary character, shape, or constitution, of which there are nearly 100, are drawn with a delicacy and precision worthy of an accomplished artist. It presents a record of those objects so interesting, as forming the basis of our speculations on the physical constitution of the heavens, which are observable in the hemisphere, which is sufficiently perfect to become a standard of reference for all future observers, and which will furnish the means of ascertaining the changes, whether periodical or not, which many of them are probably destined to undergo. I trust, gentlemen, that a long time will not elapse before we shall be enabled to welcome the return of Sir John Herschel to this country, with materials for a catalogue of the nebulæ of the southern hemisphere, as perfect and as comprehensive as that which we are now called upon to signalize with the highest mark of approbation which it is in our power to bestow. He then will have fixed the monuments of an imperishable fame in every region of the heavens."

*Thermometers.*—Some remarks made by M. Arago not long since in the Académie des Sciences, respecting the want of agreement in thermometers, gave rise to much discussion, and it was asked, whether isothermic lines and other deductions from observations of the thermometer, have no title to confidence? In consequence of this discussion, M. Arago produced the register of the thermometers in the Observatory for 1837, and that of M. Collardeau's thermometers; from the comparison of which, it appears, that those instruments often differ from one another a degree or more, but in so irregular a manner as to show that the discrepancy cannot be ascribed to any fault in their construction. The fact thus proved was acknowledged to be

of great importance. We venture to suggest, that the repulsion which the tube exercises on the mercurial column will vary in different specimens of glass, and in the same tube it will vary with every change of atmospheric electricity, so as to occasion the irregularities complained of. If this view of the matter be correct, it would, perhaps, be an improvement in thermometers to cover the under surface of the tube with a plate of tin foil.—*Athenæum.*

*Premiums for Improvements in Carpentry.*—In the year 1837, Mrs. Hannah Acton, of Euston Square, made a gift to the Society of Arts of the sum of 500*l.*, for the purpose of enabling the Society to offer an Annual Premium for the promotion of practical Carpentry, in any of its various applications to civil, naval and military architecture. In compliance with the terms of this donation, the Society give every year a gold medallion for the best design in carpentry for a previously specified description. The premium for 1842, the competition for which closes on the third Tuesday in January, 1842, is for the best design for the hull timbers of a steam vessel of 1,000 tons burden. For 1843, the gold medallion is to be bestowed on "the best design for a wooden bridge, having reference to strength, durability, economy and beauty;" and competitors for this premium must send in their models or drawings to the Society, on or before the third Tuesday in January, 1843. If drawings are sent in, they must consist of a plan and section, at least, with any other explanatory drawings which the competitor may think proper to furnish.—*Mechanics' Almanack.*

*Wood Pavements* continue to extend. The trials to which they have been subjected prove clearly that the stability of pavements depends not on the shape or interlocking, however artificial, of the blocks, whether of wood or stone, composing the pavement itself; but on the firmness of the foundation on which they are laid. In the latter specimens recently laid down in the metropolis, a foundation of several inches thick of concrete made with cement, has given proof of its sufficiency, by the pavement retaining a beautiful evenness. No kind of block has succeeded where this precaution has been neglected, as might easily have been proved beforehand would be the case. The surface of every piece of wood pavement in the metropolis is shamefully neglected. The mud composed of the grindings of stone pavement, or macadamised metal, is carried on to it from each end by the passing vehick [illegible] ate the ithe [illegible] ed into a covering as smooth and slippery as butter. When wood pavement is dry and clean, so that the [illegible] of the h[illegible] s pr[illegible] i the [illegible] d, the is no slipperiness which ought to be considered as detracting from the great advantages of this material for pavements. When it is thoroughly wet and not dirty, the same remark is nearly true: though cleanliness is therefore indispensable to a fair trial, and the ultimate success of wood pavement; and that cleanliness may be effected now without much expense, and will be accomplished still more cheaply as the length of each plot of wood pavement in use extends. A *small* quantity of fine sand spread daily on the surface might do good. Some projectors are cutting grooves to prevent horses from slipping, without reflecting that the shoes of horses are rarely, for many days together in a condition to take advantage of the grooves. *Mechanics' Almanack.*

*Theory Corrected by Practice.*—It is a commonly-received opinion, and one sanctioned by many works of high authority in civil engineering, that "earth in its natural state occupies less space than when broken up." But it appears from a series of observations very carefully made by Mr. Ellwood Morris, C. E., and recorded in the *Franklin Journal*, (October 1841) that the fact is just the reverse, native earth when broken up and formed into banks, being invariably found to suffer a *diminution* in bulk. In the case of light sandy earth it amounted to an eighth, and of gravel to a twelfth. The case is different with rock, which, when excavated, broken up and carried into bank, commonly occupies about twice its original space. A hard sandstone rock, quarried in large fragments was encreased in volume about four-twelfths; and a blue slate rock broken up into small pieces, showed an increase in bank of nearly six-tenths.

*Gold Wash for Jewellery.*—Messrs. Edmund Heeley, and Co., of Birmingham, have lately introduced to public notice a liquid which they have manufactured and used in private for some time past, for counteracting the injury sustained by delicate and expensive Jewellery, through the usual and necessary exposure for sale, which has hitherto proved a source of great complaint, and pecuniary loss to the shopkeeper. This liquid has been most successfully employed for restoring to their original colour, the most fragile and delicate Foreign and English Bright and Dead Gold, and Gilt Jewellery. This wash has the farther advantage of not injuring, in any way, the set pearls or stones contained in the jewellery.

*The "Thames" Royal Mail Steam-Packet.*—An excursion down the river from the Brunswick-wharf to Greenhithe and back was made in this vessel on Tuesday last, by Mr. Maudslay, the engineer, Mr. Pilcher, the ship-builder, and builder of the "Thames," and a numerous company of gentlemen connected with, or interested in, the Royal mail steamers. The vessel proceeded down the river shortly after eleven o'clock, and returned to her moorings a little before three. Her performance gave great satisfaction to all who witnessed her progress down and up the river. She is one of the vessels destined to carry the mails to the West Indies. Five of these vessels are now at Southampton, and are about to sail for their respective destinations in a few days; and three are at Blackwall or in the East India Docks, being prepared to proceed on their several voyages. They are all very fine vessels. The "Thames" is of 1,800 tons burden, and of 100 horse power; she measures from stem to stern, 216 feet; her breadth of beam is about 46 feet; she is rigged with three masts, her deck is flush, and not divided by the paddle-boxes, as in smaller steamers. She was built at Northfleet, and is a very superior model of her class of vessels.—*Times.*

*The rival Gun manufactures of England and Belgium.*—The reputation of the arms fabricated in Belgium is now well established. The principal seat of this industry is at Liege, which numbers within its jurisdiction more than fifty manufactories, and most of them in a high and flourishing condition. Their products are exported to South America, Egypt, Turkey, Germany, Italy, Spain, and even the United States, where they are preferred to the Birmingham arms. Be this as it may, it is a well known fact, that gun and pistol barrels, and locks, are sent to England, where they are mounted and *marked*, and sold for three times the Belgian prices; but this is owing somewhat to the superior style in which they are finished in England. The total number of all kinds of arms exported from Belgium to all parts of the world, amounted, in 1836, to 349,379; the estimated value of which was, 1,400,000 dollars, and since that time the manufacture has greatly increased—perhaps nearly doubled. There are now more arms manufactured in Liege than in the whole of France; and it even exceeds in this respect, Birmingham, which is regarded as the great armoury of England.—*Notes on Belgium, by Captain Hughes, United States Topog. Engineer.*

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# Mechanics' Magazine,

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## RATCLIFF'S PATENT INKSTAND.

Fig. 1.

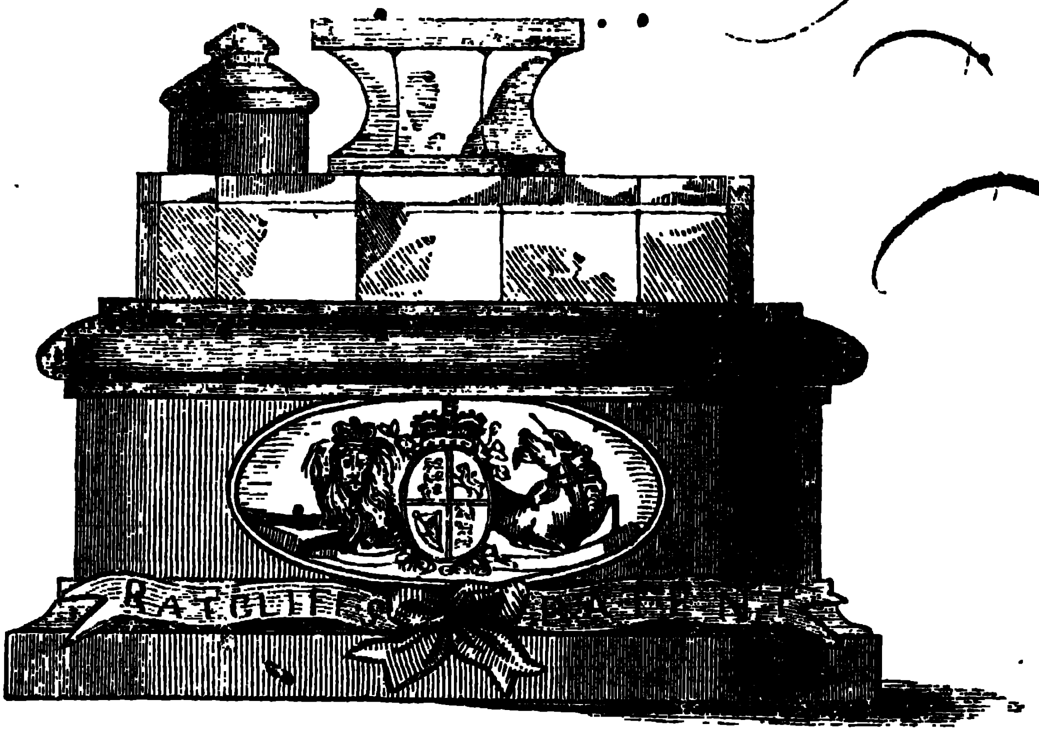
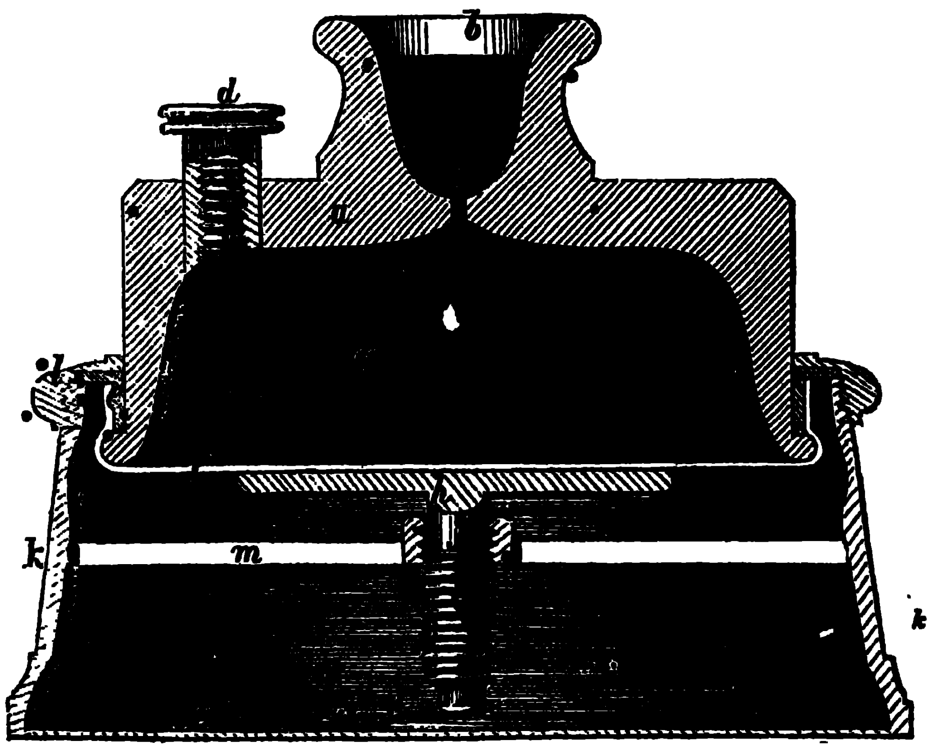


Fig. 2.



## RATCLIFF'S PATENT INKSTAND.

There are few articles upon which so much ingenuity has been employed as inkstands, but hitherto no person has succeeded in producing one wholly free from exception.

The best of those now in use are the Fountain Inkstands, which have the advantage of presenting but a small surface of ink to evaporation, and of offering the ink for use at one uniform height, in a dipping place of convenient form and size; but all of this class are open to the following objections:—

1. In the first place, the ink being drawn from the *bottom* of the inkstand, the sediment is presented for use, while the clear ink is inaccessible; this has the additional disadvantage of quickly fouling the dipping-place, and choking up the tube that leads to it.

2. The ink-holder being partly occupied by air in contact with the surface of the ink, the ink has a tendency to become mouldy—this action taking place even in a corked bottle, unless it be quite full.

3. The air which occupies the upper portion of the ink-holder being liable to expand with every increase of temperature, the ink is by that means forced out, spoiling any article of furniture with which it may come in contact. The same effect may be produced by a sudden fall of the barometer; and if both, as is sometimes the case, happen together, the mischief is increased.

Ratcliff's patent inkstand* is now offered as free from all these defects. In this ingenious contrivance, the ink for use flows from the surface of the reservoir, the sediment remaining below. The ink-holder is always full, and the ink can never become mouldy by contact with the air; no variation of temperature, or of barometric pressure, affects in the smallest degree the level of the ink in the dipping-place.

The manner in which these several advantages have been obtained will be understood by reference to the engravings on our front page; of which fig. 1 is an external view of the inkstand, and fig. 2 a vertical section of the same. *a a* is the glass ink-holder, open at bottom, and furnished with a dipping-place *b*, which communicates with the interior of the ink-holder by a small passage *c*. *d* is an opening through which the inkstand is filled, closed by a screwed nut or cap. *e* is a metal ring surrounding the glass ink-holder, to which is affixed a diaphragm of India rubber, or other elastic substance, *f f*. *g* is the ink. *h* is a metal plate cemented to the diaphragm *f*, having beneath it the vertical screw *j*.

*k k* is a cylindrical metal casing, which forms the stand, and in which the ink-holder turns freely, by the ring *e* being enclosed by the washer *l l*. There is a cross-bar, *m m*, affixed to the casing *k*, having a female screw in its centre, through which the screw *j* works.

The metal plate *h h* being drawn down, by turning the ink-holder, to the lowest point, the ink-holder is filled with ink through the opening *d*; on turning the ink-holder in the opposite direction, the screw causes the plate *h* to rise, and pressing in the diaphragm *f*, diminishes the capacity of the ink-holder, thereby causing the ink to rise into the dipping-place *b*. When done with, a revolution or two returns the ink into the reservoir. There is a spring *n*, below the screw *j*, to assist its rising; and part of the screw-thread is turned off at top and bottom, to prevent any injury arising from the ink-holder being turned too far in either direction.

The simplicity of the mechanism renders it impossible for this inkstand to get out of order, unless wilfully misused or violently damaged; and by taking out the stopper *d* it can be washed out as easily as a common office inkstand.

* E. Heeley and Co., agents, Birmingham.

## LIFE AND LABOURS OF TELFORD. NO. XII.

### *Telford's Latest Works—Institution of Civil Engineers—The "Telford Medals." Retirement, Death, and Funeral.*

[Concluded from page 327.]

Most of the principal works of Telford have now been noticed in these papers, and the remainder are not of such a nature as to call for lengthened remark or a detailed description. Among these, the St. Katharine's Docks were conspicuous, not so much for their extent, which is necessarily circumscribed from the nature of the site, as for the astonishing celerity of their execution, and the extraordinary tact displayed by the directing engineer in turning to account every corner and cranny of the small space he had at his command, owing to which the accommodation afforded to shipping is so extensive, that it is hardly possible to believe the two capacious docks can have been carved out of the very limited area of twenty-six acres—such nevertheless is the absolute fact. A plan, under parliamentary auspices, for supplying the Metropolis with that great desideratum, pure water, occupied much of Telford's time and attention in his latter years. He proposed, after elaborate surveys of the surrounding country, and the very fullest consideration of all the circumstances, to derive the supply for Northern London from the river Verulam, or Colne, near Watford, and to convey the essential fluid the whole distance (14 miles) in a covered aqueduct, protected alike from the admixture of the drainings from the surface of the adjacent lands, and from the incursions of bathers, whether human or canine. This plan has not yet been carried into effect, but a company has been recently started for prosecuting a similar scheme, the chief difference being, that it is now proposed to procure the supply from a well to be dug close to the river, instead of from the river itself, which Telford intended to divert entirely, compensation being made to the millers on the lower part of its course, (who would necessarily lose their motive power) either by a sum of money, or by the erection of steam-machinery in lieu of their mills. The new company offer no compensation at all, as they profess to believe they shall do no injury; but their scheme has met with so vigorous an opposition from the land and mill-owners of all the surrounding country, on the ground that the taking of the vast body of water required will dry up the sources of all the neighbouring streams, even *before* they can reach the surface of the earth—that there seems little chance of the passing of the bill through parliament. It was another branch of Telford's plan, also, to bring the waters of the River Wandle, in Surrey, to the Southern part of the Metropolis; and a company for effecting this improvement likewise, is now in agitation.

The union of the English and the Bristol channels by means of a ship canal was skilfully provided for in another of the yet-unexecuted plans of Telford, but the improvement of Dover Harbour was the last public work upon which he was practically engaged, and upon this he was actively employed, even up to a short time before his decease. This completes the catalogue of those "Labours of Telford" which stand in the first rank for extent and importance.

It would be unpardonable, however, to conclude this series without some notice of a "foundation," which, remote as it might be from the walk in which his powers were usually exercised, and connected more with Mind than Matter, may perhaps serve as effectually to "link the name" of Telford "with succeeding time," as many of his most stupendous fabrics of stone and iron. It will be guessed that the allusion is to the "Institution of Civil Engineers," which, if it did not owe its origin to Telford, at least gratefully acknowledges that *his* hand moulded it to its present "form and pressure."

The profession of the Civil Engineer can hardly be said to have existed at all in England before the middle of the last century, and one of the first and most illustrious of the band, JOHN SMEATON, established the oldest association of its members on record, in the year 1771. This society was re-organised in 1793, and distinguished itself by publishing, under the direction of a

sub-committee, that highly valued work "Smeaton's Reports." This club, although little known, still exists under the title of "The Smeatonian Society of Civil Engineers," holding its meetings monthly at the Freemason's Tavern, during the Session of Parliament, when all the members of the profession are usually called to town. Telford himself was a member of this body, in common with the leading engineers of the day, but in his opinion, the Society was of too private a nature to effect much good; and on this opinion he was not slow to act, when the occasion offered. In 1817, a few gentlemen, then beginning life, but many of whose names are now familiar to the scientific world,* impressed with the difficulty which existed in obtaining knowledge on engineering subjects, resolved to form themselves into a Society for promoting intercourse, and the exchange of information, among those devoted to its various branches. The first meeting for this purpose was held at the King's Head Tavern, in Cheapside, on the 2nd of January, 1818, when a number of rules were adopted, which continue even now to be the basis of the fundamental laws of the "Institution of Civil Engineers," the origin of which is dated from this meeting. The Society so formed continued to assemble regularly during its session for the two succeeding years, without attracting any show of public attention, and without change in its character or constituent members.

At the end of that time a resolution was adopted, which almost immediately led to a thorough alteration in its constitution, and to its taking a high station among the principal scientific associations of the day. This important resolution was (to use its own words) "that, in order to give effect to the principle of the institution, and to render its advantages more general, both to members and the country, it is expedient to extend its provisions to the election of a President, whose extensive practice as a Civil Engineer has gained him the first-rate reputation; and that a respectful communication be made to Thomas Telford, Esq., C. E., to patronize the Institution, by taking on himself the office of President." At this period the Society was so little known, that Telford had actually never heard of its name before this application was made to him. But this formed no obstacle; as soon as he perceived what an instrument of benefit such an establishment might become, if properly supported, he paused not a moment, but at once gave his consent to the proposed measure, and was duly installed as President on the 21st of March, 1820, distinguishing himself on the occasion by the excellent remarks he took the opportunity of making on the usefulness of such a Society, and the proper method of conducting its affairs.

It may almost be said, that the Institution of Civil Engineers, as the term is now understood, took its rise from this event, rather than from any which preceded it, so great and so essential was the change which the accession of Telford's name and reputation, joined to his active personal exertions, rapidly worked in its fortunes; until at length, through his influence, it was in 1828 incorporated by royal charter, taking rank among the regularly established associations of the country,—and not, it might be added, as the least, if it were the last among them.

A few years after, Telford began to contract his engagements, and, as he gradually withdrew from the toils of business, his attention became more and more concentrated on this, as it were his only child, and the last object of his solicitude, the care of which gave employment to his mind in the evening of his days, free from the too violent excitement apt to be produced by the active duties of professional life. The rising Society thus occupied much of his time, and more of his thoughts; its collections were enriched by his bounty, and when, full of years and of honour, he felt the close of life approaching, he endowed the Institution with a munificent bequest. He left two thousand pounds, together with a residuary interest, which will materially augment the amount to be expended in annual premiums under the direction of the Council. Many of these premiums have been already awarded, after no small degree of competition, and it is believed, with a beneficial tendency towards one of the

* These names are assuredly worthy of preservation. They are: William Maudslay, Henry R. Palmer, Joshua Field, James Jones, Charles Collinge, and James Ashwell.

most warmly-cherished intentions of the testator; the inducing engineers, and especially young men who have the opportunity, to keep drawings and particulars of the public works with which they may be connected, for preservation in the archives of the Institution. It has been well observed, that it is by such means, and by such means only, the reproach can be removed, that "in a country possessing so many interesting works in the department of the Civil Engineer, it is almost in vain to look for the details of these as actually performed." So well was Telford himself convinced of the benefits that must arise from such a course, that he not only employed the leisure of his later years in preparing for the press a full account of the labours of his life, but left to the Institution he had fostered, besides his other bequests, a legacy of more than pecuniary value, in the shape of the whole of the original papers and drawings of the vast and varied undertakings in which he had been concerned from the beginning to the end of his long career. He hoped by this example to influence other engineers so far, that, at their deaths, their collections, instead of being completely scattered and dispersed might become a portion of the lasting treasures of an Association open to all the respectable members of the profession. Such a collection, it may be hoped, will in time become an object of even national importance in a country which, like our own, begins already to rank among its proudest boasts the great achievements of its CIVIL ENGINEERS.

It now only remains to notice the closing scene. In 1827 Telford was attacked by a severe disorder, while on a professional visit to Cambridge. From this he recovered, but not so perfectly as his friends could have wished, and he remained ever after subject to a recurrence of the disorder; so that he felt it prudent to retire, in a great measure, from the calls of business, in spite of the requisitions for his aid which his unequalled reputation naturally drew upon him. This retirement was perhaps favoured by the rapid rise of the railway system, which in his latter days turned civil engineering into a different channel from that to which he had been accustomed, and one to which he was adverse rather than favourable. As already observed, the institution he had fostered occupied the chief part of his attention during his latter years; and the time not taken up by that was principally devoted to the compilation of the detailed work on his life and labours, from which the chief part of the materials of the series of papers now concluded has been derived. He had just finished this work, ready for the press, had seen to the engraving of most of the plates, and arranged for the appearance of the whole, under the superintendence of his friend Mr. Rickman, (the expenses being provided for in his will,) when an attack of illness of unusual severity proved fatal. He died at his house at Westminster, on the 2nd of September, 1834.

He had desired to be interred privately, in the parish church of St. Margaret's; but the members of the Institution of Civil Engineers interposed, and successfully urged on the executors the propriety of placing the remains of the most eminent of their body in the great national repository, Westminster Abbey. His funeral was attended by all the more eminent members of the Institution, the present president, Mr. James Walker, at their head, accompanied by the attached and faithful friend of the deceased, Sir Henry Parnell, now Baron Congleton. The exact spot of interment is marked by the name "Telford," and the date, "1834."

A subscription was set on foot almost immediately after, for the purpose of erecting a monumental statue, from the design of Mr. E. H. Baily, the celebrated sculptor. The call was eagerly responded to, and its object has, it is believed, been carried into effect; but no public testimonial at all adequate to the occasion has yet been dedicated to his name. It has indeed been urged, that any such erection is totally unnecessary; and it may well be maintained that the name of TELFORD will stand in need of no perpetuation, so long as the Pont-y-Cyssyllte bestrides the "vale of Cambrian Dee," or the Strait of Menai owns subjection to the "bending bridge" that hangs "aloft in air" above its waters. Till *they* have disappeared, we may safely say—

"His monument shall be his *works* alone."

THE SYMINGTON SYSTEM OF CONDENSATION.

Sir,—The favourable opinion you have been pleased to express of the Symington Method of Condensation, in your 956th number, induces me to request that you will give this communication, concerning that invention, insertion in your valuable journal.

It is admitted, on all hands, that the incrustation in the boilers of marine steam-engines is one of the greatest drawbacks to steam navigation: as it not only leads to the corrosion of the boilers and other parts of the machinery, but, being an imperfect conductor of heat, prevents a sufficient supply of steam from being generated, without an extravagant waste of fuel. By the Symington plan of condensation the evil is thus obviated. The steam-engine condensement, formed by the mixing of the steam with the cold water in the condenser, after supplying the boilers with pure fresh water, instead of being thrown overboard as in the common plan, is cooled down in the sea or river in which the vessel floats, and used again for condensing, by injection, and being returned to the boilers. The apparatus by which this is accomplished consists of copper pipes, placed externally and horizontally to the vessel, any where below the line of floatation which may be deemed most convenient.

Being an *appendage* to the steam-engine, it involves no change in its construction; and being placed externally, in the sea or river, the best of all possible tanks, it occupies but little internal space, and must cool down the water much more rapidly than any means which could be used inside of the vessel.

Its cost is but trifling, seeing the benefits it confers; its simplicity and freeness from complication rendering it inexpensive in its construction, and the copper of which it is composed being always valuable. By the mere turning of a cock, it can be used separately or in conjunction with the common plan, whereby alternate trials of the two plans can be made with the greatest accuracy and facility.

Were an accident to happen to it externally, (a thing which has never yet occurred,) the vessel could suffer no detention; for precisely to the extent to which the water could find admission to the pipes, would be the return to the common plan. Indeed, were the whole of the apparatus carried away, the worst that could happen would be, that without the turning of cocks, or using any other means to commence it, the common plan of condensation would instantly come into full operation.

Trials made with the apparatus prove, 1. That the boilers are kept perfectly clean; 2. That a third, or at least one-fourth of fuel is saved; 3. That a good vacuum is maintained; 4. That there is an abundant supply of steam,—consequently, an increase of power; 5. That the strokes of the engines exceed the usual number; 6. That the risk of explosion is almost totally removed; 7. That priming, or "foamenting" from water getting into the cylinder from the boiler, and showering from the steam-pipe like rain upon the deck, and also upon the passengers, to the injury of their apparel is prevented; and 8. That time, labour, and anxiety are saved to the engineers and stokers, by there being no need for blowing off the water from the boilers during the voyage, or for emptying and cleaning them out when they reach their destination.

The invention has been fitted to three steam-vessels—the *City of Londonderry*, the *Dragon* steam-tug of London, and the *Fletcher's Despatch*, of Goole; and they were all fitted on the understanding, that if the plan did not answer, their proprietors were to incur no expense. Time, however, was to be allowed for making any alterations deemed necessary.

The *City of Londonderry*, being the first attempted to be fitted, had not quite enough of pipe allowed, which rendered it necessary, when going at full speed, to admit a small portion of outside water. With this assistance she was able to make good her voyages in time, to consume nearly a third less fuel, and to return with cleaner boilers from Gibraltar than when she left London. Notwithstanding the advantages conferred by the invention, the proprietors of the *City of Londonderry* would not allow an opportunity for completing the apparatus; and at the end of six months, the parties interested in the patent being unable either to obtain payment for the apparatus, or any assurance that they would ever be allowed to complete it, insisted upon its being removed. To this the proprietors assented; but after the apparatus was removed, the vessel was unable to make her voyages in proper time, and she soon ceased to belong to the Post-office service.

With the *Dragon* and the *Fletcher's Despatch*, it gave the greatest satisfaction; and Mr. Fletcher is so much pleased, that he has, in the most generous and handsome manner, offered to such parties as may wish to satisfy themselves of the value of the invention the opportunity of going on board of his boat, even for a month, if they think proper, and trying the new and old plans, the one against the other.

There is no greater bar to improvement than preconceived opinions formed and expressed by parties incompetent, either through want of ability, or through giving the subject too little consideration, to form a correct judgment. The Symington system of con-

densation, like many other most valuable improvements, has suffered much in this way; theoretical objections having been started, which experience has detected to be perfectly at variance with truth. Among these objections may be instanced the following.

*Objection First.*—It was predicted, that the pipes would be torn off by the violence of the sea, by striking upon rocks, the vessel taking the ground, or coming into collision with other vessels.

To show the fallacy of these predictions, the following facts may be sufficient.

1. A naval officer inquired of one of the parties concerned in fitting the *City of Londonderry*, if he had ever crossed the Bay of Biscay? On being told he had not, "I thought so," said he, "otherwise you could never have expected the pipes to return to England; for, to a certainty, they would be torn from her sides by the heavy seas she would meet with in that bay." Notwithstanding this opinion, so confidently expressed, the pipes, after having remained attached to the *Londonderry* from July until March, were found as sound and as well fixed as the day they were applied.

2. When it was proposed to fit the *Dragon* steam-tug, it was repeatedly described as a ridiculous scheme, for that the pipes must be stripped off, or seriously injured, by the numerous vessels traversing the Thames in all directions; and it was most confidently asserted, that deep-laden barges, and the boathooks of watermen, could not fail to cause destruction to the apparatus. But so far from these predictions being verified, the *Dragon*, after towing in the river, along the coast, and even down the Channel, in very bad weather—after repeatedly coming into collision with ships, barges, and boats—and after assisting in attempts made to raise a wreck, was, when examined a few weeks ago, so far as regarded the apparatus, as sound and secure as when first fitted to her.

3. As to the *Fletcher's Despatch*, it was sure, it was said, to be a failure, for the water in the Humber was as thick as chocolate, and the banks in many places composed of earth and faggots, the projecting ends of which would scrape the pipes completely from her sides. Only a few weeks since, however, this vessel, which has been constantly at work for upwards of two years, was found with boilers as clean as when put on board, and the apparatus perfectly secure and in good order.

So much for prejudging what is not understood! Had Mr. Fletcher allowed his judgment to be warped by the engineers who fitted the engine into the *Fletcher's Despatch*, he would have had nothing to do with the invention. Entertaining a favourable opinion of it himself, and having fortunately met with the engineer who had wrought it in the *Londonderry*, he was confirmed in the belief that it was likely to prove valuable.

*Objection Second.*—That the pipes would impede the vessel's progress.

However plausible this may seem in theory, it is worth nothing in practice; for the *City of Londonderry* made her voyage in good time, but could not do so without them. The *Dragon* improved in speed with them. And the *Fletcher's Despatch* is considered the fastest little boat upon the Humber.

In addition to what has been said, it may be as well to notice, that several engineers have declared that they could not see how a saving of one-fourth of the fuel could be effected by using the Symington Condensing Apparatus. But had these gentlemen, like the illustrious Watt, combined chemical with their mechanical knowledge, it is extremely probable they would soon have seen the causes which produced it. For,

1. If water, before it becomes steam, and steam itself under pressure, do not by means of the thermometer indicate all the heat they contain, when it is considered how often, with the common plan, a large quantity of hot water is blown out of the boilers to prevent incrustation, and that with the Symington plan there is no blowing away of hot water, can there be a doubt that a very great saving is effected?

2. If the substance incrusting the boilers be an imperfect conductor of heat, as there is no doubt it is, will the clean boilers afforded by the Symington plan do nothing to save fuel?

3. If pure fresh distilled water be more easily raised into steam than that which is muddy, thick, and loaded with impurities, or contains much saline matter, will the pure fresh distilled water given by the Symington plan not answer better than the impure outside water supplied by the common plan?

4. If air, especially in the condenser, when expanded by heat, be a hindrance to the action of the steam-engine, will the Symington plan, whereby air is at once expelled, and afterwards excluded, give less power to the engine than the common plan, which, with every jet of water thrown into the condenser, sends in a quantity of air?

The trials made with the *City of Londonderry*, the *Dragon*, and the *Fletcher's Despatch*, show a saving of nearly one-third, which result is the more convincing, that it was arrived at in various places, at different times, and by engineers unacquainted with each other.

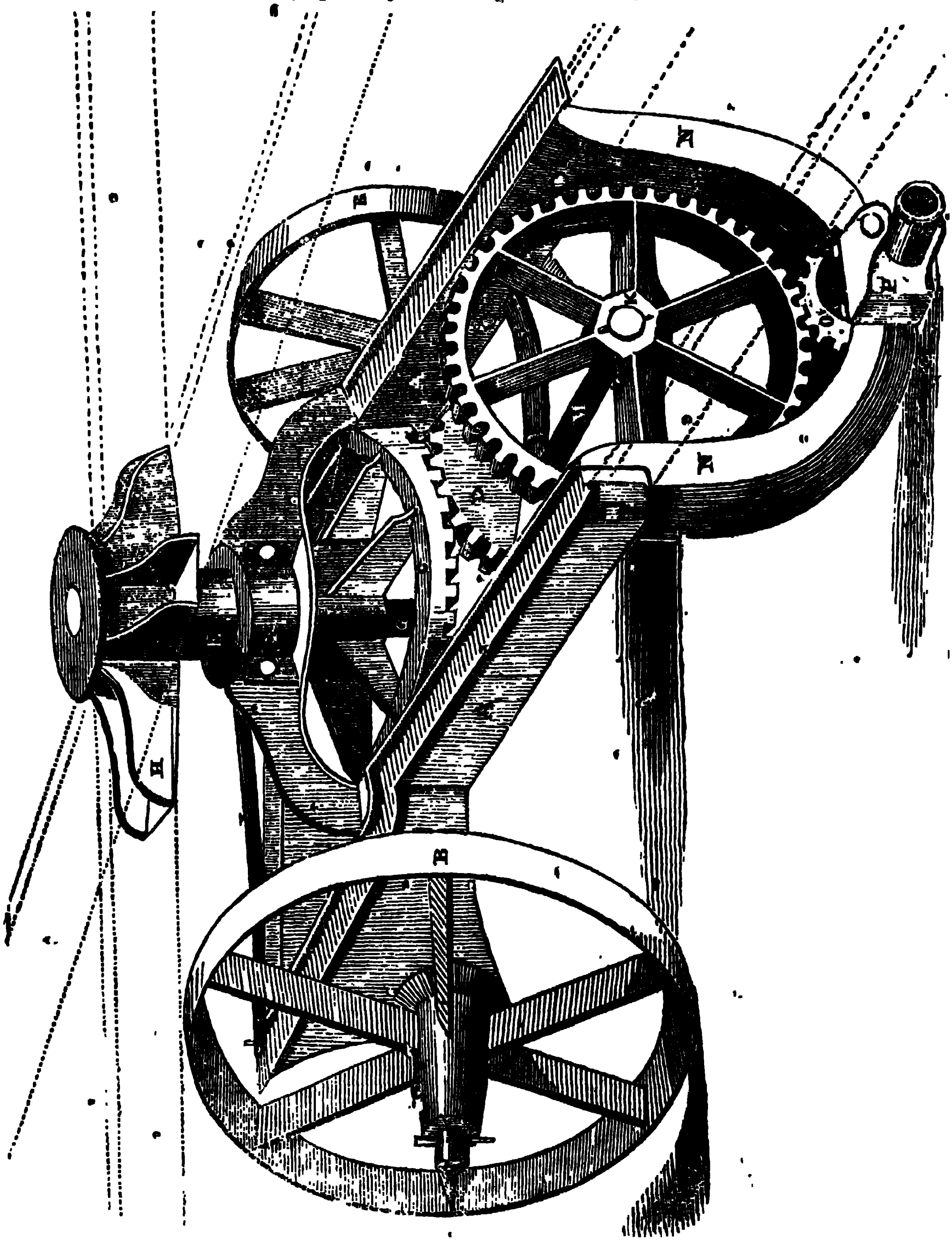
Apologising for this lengthened detail, and hoping that the proprietors of steam shipping will strictly examine into the facts which I would thus lay before them,

I remain, Sir, your very obedient servant,

ROBERT BOWIE.

PLENTY'S HORSE POWER FOR THRESHING MACHINES.

(Registered pursuant to Act of Parliament.)




The above engraving represents the horse power, or out-door work of a threshing machine, invented by Messrs. Joseph and Edward Plenty, iron founders, Newbury, Berks. It is wholly of cast iron, and will therefore sustain uninjured, for a great number of years, the constant exposure to rain and damp, to which all out-door works of moveable machines must necessarily be exposed, and which must inevitably prove destructive to those commonly employed, in the course of a few years.

A A is the frame; B B the carriage

wheels; C the horse wheel; D the horse-wheel pinion; E, shaft; F, a bridge that supports the shaft E; G, the step of the shaft taking a bearing on the carriage wheels axletree; H, the cap or lever socket; I, the brace; J, the horse wheel pinion bracket, or bearing piece; K, the pit wheel; L, the pit-wheel bracket; M, the pit-wheel shaft; N N, the pit-wheel pinion frame; O, the pit-wheel pinion; P, an universal joint for connecting the apparatus with the inside work of the threshing machine.

By the adoption of this out-door work, the original cost of a threshing machine is reduced one-third. Another advantage is its portability, in travelling from one barn to another, as its compactness and comparative lightness enable it to be moved with facility and dispatch. There is also a great saving of time and labour in placing the machine in a proper position for performing its work. The common machine requires five or six men to effect this object, whereas, in the present machine, one man alone can easily accomplish all that is required in five minutes.

Finally, the simplicity, durability, and strength of the new machine reduce the liability to derangement, in so great a degree, as to ensure its efficient working for many years at a very trifling expense.

ROBINSON'S PATENTED IMPROVEMENTS IN SUGAR MILLS.

Sir,—Having on my return to England, seen the remarks of A. B. C. on Mr. Robinson's sugar-cane mills, in your No. 952, (page 362,) I was induced to investigate the merits of this (to me important) invention; and I feel bound to state that, the results of my enquiries and observations have convinced me that the invention in question embodies several very valuable improvements, and that the remarks of A. B. C. thereon, are either the result of ignorance on the subject, or the vain effort of a rival manufacturer to stay the march of improvement in this direction.

With the objection raised by A. B. C., as to the greatly varying qualities of different canes, I am quite at issue. The fact is, that in the principal sugar colonies at this time, there may be said to be but one species of cane grown, viz., the "Otaheite cane," which, on account of the abundance and richness of its juice, is now generally cultivated. The sugar-cane, like all other plants, has a well-defined season of maturity, at which it is cut, as near as may be: I am of opinion that *an average of juice may be given*, and my experience leads me to agree with those writers who have stated it at about 90 per cent.

The strength of cane juice, on good average soil, may be taken as holding in solution ⅕th of its weight of sugar; that is to say, every 100 lbs. of cane contain 18 lbs. of sugar. Now, if all the available juice be expressed by our present mills, as A. B. C. seems to think, how is it that the yield of sugar and molasses together seldom exceeds 10 per cent. of the weight of the cane, and is in general much less?

The sugar-cane, although a juicy, is a spongy, elastic plant, very tenacious of its juice, and retaining a considerable portion when, to a superficial observer, it would appear dry. When this question was first agitated last year by French writers, I weighed some of my "magass," (dried cane) and after having thoroughly dried it, I found a great difference, which could only have occurred from the evaporation of remaining moisture. I mention this fact, to show that A. B. C. is greatly in error in supposing that no juice remains in the cane after passing through an ordinary well-made "three-roll mill." This error is opposed both to fact and to theory, as will be apparent by briefly adverting to the action of this machine. The canes are fed into the rollers from a bundle by an attendant, who equalizes and spreads them out as well as the time will allow; but he cannot prevent their accumulating in double tiers at one spot, and from passing through singly at others, leaving some spaces between the rollers altogether vacant. In order to prevent the stopping or breakage of the rollers, they are necessarily adjusted to the double thickness, and therefore the single canes are not sufficiently pressed. Nor is this the only evil, for at the vacant spaces between the canes, the juice in passing through

is absorbed by the crushed canes on their expansion as they emerge from the rollers. Again, in their onward passage between the first pair of rollers, the canes are inclined downward, and the juice released by the pressure, instead of falling down into the receiving pan, is disposed to run down the bruised canes and to be absorbed by them. Thus, although the first pair of rollers bruise the canes, they separate the juice from them very imperfectly, and on the canes reaching the second pair of rollers, the superabundant juice disposes itself over every part of space where there are blanks, passing out to the spongy "magass." It should ever be borne in mind by the sugar millwright, that merely bruising the canes does not separate the juice from them; was the course of the canes to be inclined downward through all the rollers, for instance, no degree of pressure would extract the juice.

So far as I am aware, Mr. Robinson is the first engineer who has provided a sufficient remedy for the defective action of the common mill; his feed apparatus (of which I was shown two kinds,) by supplying the material regularly and equally, will go very far to secure a perfect expression of the juice, as well as to prevent undue straining of the machinery.

Were the rollers of Mr. Robinson's mill, as stated by A. B. C., "excessively small in diameter," I should agree with him in pronouncing it "a real evil." But as the diameter of Mr. Robinson's smallest roller is 16 inches, while the ordinary rollers are only 18 or 20 inches, I cannot believe that any real objection can be founded on so slight a difference. It appears to me that rollers of this size will be equally effective in expressing the juice as larger ones: the pinch is sharper, and the juice will run off more readily.

The advantage of "gradually drawing in the canes" is more fully realised by Mr. Robinson's mill, than in the old ones; the bulk of the canes being reduced in three successive pressures, each one more intense than the preceding; an arrangement that will be admitted to effect the lamination of any substance most economically.

In the patent mill, the canes do not pass through the first pair of rollers in a downward course, and therefore the juice will not pass through *with* the canes, but be excluded from them as it is squeezed out. So far from the operation of the new mill being "*exactly on a par*" with that of the old one, it must be evident to all that it is essentially and importantly different. But what A. B. C. evidently intends to be the most triumphant charge against Mr. Robinson's improvements, is the "deluging the canes with hot water." On enquiry, however, I find that the object of providing a jet-pipe, by which steam or hot water *may* be distributed over the canes previous to giving them the last pressure, is to enable the planter advantageously to work such canes as have passed their maturity, and though deficient in juice, are, nevertheless, rich in sugar; but the moistening forms no part of the process in operating upon ordinary canes.

With respect to the fallacy respecting the consumption of fuel to evaporate "the watery particles already in the juice," I would observe that the manufacture of sugar from the cane, may be said to be accomplished *without fuel;* as the refuse cane, or "magass," when dried in the sun, is found sufficient, on all sugar estates, to evaporate the juice, and to supply the steam-engine furnace, where one is employed, also.

The question of breakage may be very summarily disposed of; the universal voice of planters in every colony where steam-engines are employed, will, I venture to say, be at variance with A. B. C.'s opinion of the security of the ordinary machinery. The state of matters in one colony within my knowledge will form a good illustration of this point. In this colony there are about fifty sugar-mills driven by steam power; these mills, with a few exceptions, bear the name of one of the oldest and most eminent mill-makers in England; they have all three rolls and iron framing, and a great many have wrought-iron bars; yet, more than half of this number have been repaired, not by the maker, at some thousands of miles distance, but by the unfortunate planter, in such a rude and imperfect manner, as the colonial blacksmith could accomplish. From my own experience I am bound to admit, that I consider Mr. Robinson fully borne out

in his assertion *that breakage is an accident of common occurrence in the colonies.* And it seems to me that Mr. Robinson's plan of arranging his rollers in pairs, with a malleable iron strap embracing the gudgeons or centres annularly, is admirably adapted to supply the strength which has been hitherto wanted. By this means, the risk of breaking the side frames, however great the pressure, is completely guarded against.

The whole of A. B. C.'s letter appears to evince more of feeling than of mechanical acumen, and I am inclined to think that his remarks will (as in my own case) tend to produce a questioning of the character of the old mill, little calculated to forward the views of those who supply them.

Much remains to be done to bring the process of extracting sugar from the cane to a reasonable degree of perfection. Beet root of average quality contains 9 per cent. of sugar; the cane contains 18 per cent. By scientific treatment the yield of sugar from beet root has been raised from 3 per cent. (all that could be obtained in 1831,) to 6 and 7 per cent., and the quality so much improved, that from a substance hardly recognizable as sugar, it now rivals the best.

By the present process, the average yield from the cane is, in sugar and molasses, about 10 per cent. Why should it not by similar means to those employed by the beet root manufacturers be similarly increased?

I am, Sir, your obedient servant,

A PLANTER.

London, December 11, 1841.

## ON THE CAUSES OF INJURY TO STEAM-BOILERS.—BY C. W. WILLIAMS, ESQ.

Sir,—In my last paper on the above subject, (page 455,) I alluded to the prevailing opinion respecting the source of danger to boilers, namely, that it arises from the sudden breaking up of the incrusted matter, which, by reason of its non-conducting property, caused the plate beneath to become overheated—that by this means a sudden approach of water to the overheated plate was effected, and, necessarily, a commensurate development of steam of a highly elastic force, from which bulging, rupture, or explosion might ensue. The whole of these facts and inferences I have ventured to dispute, on this ground—that this crystallized incrustation was a good conductor of heat, instead of a bad one—that it could not therefore be the cause of the plate becoming overheated—and, consequently, that the whole theory of this sudden generation of steam was proved to be unsound. I then observed that the real source of danger arose from the uncrystallized and suspended matter. Now, this matter, usually a carbonate or sulphate of lime, being precipitated on cooling, and necessarily subsiding to the lowest parts of the boiler, becomes a consolidated mass, frequently many inches in thickness, and reduced to the state of baked earth.

On the fires being again lighted, after each interval of rest, this indurated deposit prevents the approach of the water to the plate; an imperfect, instead of the most perfect, recipient of heat is thus presented to it, and overheating, with all its consequences, necessarily follows.

In a late paper by Mr. Parkes, on the causes of explosion of boilers, and in reference to the late accident at Derwent Crook, he observes, "It appears from the evidence given on the inquest, that the internal state of the boiler, as manifested by the quantity of deposit ejected, is quite sufficient to account for its dislocation." Now, this is a matter of fact quite to the point. Had this matter assumed the form of an incrustation, it neither could have proved a non-conductor, nor would we, in that case, have had the demonstrative proof of its being in a state to be so "ejected."

Mr. Parkes goes on further to say—

"Nor is it requisite that a boiler should be red hot to generate such steam. A temperature far below redness suffices, so that nothing can be detected from the subsequent appearance of the plates.

"When a fire is slackened under a boiler, deposition of the suspended earthy matter takes place. *It should then be blown out.* If not, the mass becomes thickened, (though not, perhaps, indurated:) it prevents free access of water to the plates; and an outbreak of flame, from even a previously smothered low fire, happening when a boiler is thickly coated with mud, might produce the calamity which occurred at Derwent Crook."

This also is quite to the point, for

here a defective recipient of heat, namely, this "thickened mass," is interposed, and by its non-conducting property obstructs the exit of the heat, and its passage to the water. The result is, that in proportion as the *current* of heat is obstructed, it becomes *accumulated*—a degree of congestion, if I may so speak, takes place, and the conductor (the plate) becomes necessarily over-heated.

It is important here to notice, that these effects are never produced, except in such parts of a boiler as are necessarily low, and so circumstanced as to receive this deposit, which subsides by mere gravitation, and which, at the same time, are exposed to the greatest heat from the furnace.

When this matter has assumed the crystallized state, it may be said to have ceased to be dangerous; the reverse, when uncrystallized. When in this state, the danger is considerably increased by the presence of any solid body, accidentally, or otherwise, placed in the lowest part of a boiler. In one instance which came under my own observation, a large sledge hammer, having been accidentally dropped into the boiler and forgotten, became the nucleus around which the previously suspended matter collected and consolidated; and what might, otherwise, have been spread over a large surface, was, in this instance, brought together in a mass around the hammer; the result was, over-heating and bulging.

Under the circumstances of this suspended matter, the only remedy is either by blowing out, or by collecting it, while in suspension, and while the water is boiling, by some of the mechanical means which are now well understood. These latter will do more towards preventing injury to boilers than any system, short of uniform attention to frequent cleaning out. The conductibility of the incrustation being proved, (as shown in my last,) it was observed by Mr. Parkes that this nevertheless did not completely establish the fact of its innoxious character, inasmuch as, in the boiler, this incrusted matter is always added to the plate, and though, by itself, it was proved to be a good conductor, it did not follow that it might not obstruct the transmission of the heat when its own thickness was added to that of the plate.

This objection was manifestly a reasonable one. To put the fact to the test, I had a vessel with an *iron* bottom, ⅝th in thickness, added to the previous one of *incrustation*, also ⅝ thick; thus making an effective thickness in the bottom of one and a quarter inch.

On placing this double-bottomed boiler over the flame, I found the conductility so perfect, that it had a superior evaporative effect to that of a boiler of which the bottom was of iron alone, of the same thickness, thus setting the above question at rest.

Incrustation never adheres to any injurious extent or thickness on those parts, where, from their being exposed to the greatest heat of the furnace, the danger of over-heating might arise. This opens a new and important view of the subject in a practical point of view.

That incrusted matter is found on boilers and in large quantities is true, but never adhering to those parts *liable to injury from excessive heat*. My observation then leads me to say, that accumulation of the incrusted matter takes place by *two distinct processes*, according to the temperature of the part of the boiler to which it is liable to attach itself.

Where the heat is moderate, as in the roofs of boilers, or those parts of the flues most remote from the furnaces, and where the iron is not subject to much fluctuation as to temperature, the successive layers or strata are formed *over* each preceding one, becoming, as it were, a single stratum, accumulating until it has become one or more inches in thickness. In those parts, however, which are exposed to the greatest heat, and where the plate is subject to greater extremes of heat and cold, expansion and contraction, there the successive layers are formed *under* each other, every new layer beginning with the plate, and being in contact with it. In this state the mass becomes enlarged, it is true; but the water finding its way to the plate, beneath the incrustation, the steam generating power is not suspended, nor can any injury arise from overheating. This part of the subject I will pursue on a future occasion.

I am, Sir, yours, &c.,

C. W. WILLIAMS.

Liverpool, December 15, 1841.

PRACTICE AND PRACTICIANS, *v.* MATHEMATICS AND MATHEMATICIANS.—REPLY OF MR. CHEVERTON TO S. Y.

Sir,—It is wholly unnecessary that I should take any serious notice of the analysis of my late paper on the respective merits of practical and mathematical modes of investigation, with which your correspondent S. Y. has *favoured* you; for its coarse and imperious tone, so much in keeping with its gross misrepresentations, carries with it its own reply and condemnation. A sportive sally on the subject, although a little out of place, and indicative of the absence of ability to reason on it, would have been as pleasant to me as to any one else; but the wit of your correspondent is too ponderous and sullen to spring from light-hearted raillery; and is more akin, alas! to that unhappy disposition, which is every where apparent in his article, to distort and misrepresent. I am sorry for him; but notwithstanding this self-exposure, he must not escape without a reproof, and I administer it to him in the words of one who appears to have known him well, and from whose prophetic warnings I hope he regrets that he has not derived that benefit which he might and ought to have done.

"I have been induced, Sir, to enter thus fully into the merits of S. Y.'s communications, with a view to check that impetuous spirit by which he seems actuated, and which is evidently carrying him beyond himself, and, if not timely curbed, *will lead him at last* to the most erroneous notions in matters of science: I shall always be happy to meet S. Y. in the pages of the *Mechanics' Magazine*, but with a less imperious tone than he has heretofore assumed. I grant I have been severe, but he who spareth the rod hateth the child."

This censure alighted on your correspondent in the pages of your Magazine, when in its early days—many, very many years ago; and sad is it to think that time, which meliorates most things, has found him now even as it left him then. A tone of seriousness and pity well becomes the occasion; for such a tissue of gross misrepresentations and perversions as is contained in the article on which I animadvert is, in the eye of reason and justice, *an immorality*—private in respect to the individual, and public as it affects the interests and the progress of truth. Nor is the subject of mean consideration; it is, in its most general aspect, the philosophy of logic, or an inquiry into the procedure of the understanding in raising conclusions from premises. Of the several methods, the most prominent, and the highest in order, is the demonstrative, or the mathematical method; and it has been my object to show, that, *because* demonstration is its aim and condition, it is, from the narrow limits of human knowledge, of much less value, and much more imperfectly applicable to the solution of *practical* problems, than is generally supposed; and very inferior to the inductive methods pursued by practical men, in common with philosophers in general. This is no attack upon the mathematics, but an attempt to define its true position in reference to general usefulness. It presents, indeed, a rather humiliating view of things, but it will only irritate the vain arrogance of carping and pretending sciolists, who, because they may have got a smattering acquaintance with certain routine acquirements, assume they possess a knowledge of the philosophy of the science, and of its powers as an instrument of reasoning. To such, it appears as an absurdity to suppose that the mathematics, having sufficed to unravel the intricacies of the lunar motions, can fail in tracing the more ordinary operations of nature; and yet this is the fact, and the attempt to ridicule it by S. Y. only betrays the presumption which is the usual concomitant of ignorance led by folly. Come, I will give him a problem to solve. Let him place a weight upon a table, and draw it by a string in one direction, and then in another direction, at right angles to the former; and now let him mathematically define the curve that the weight describes. It is true, the solution of this problem exceeded the powers of a Euler; but to such a genius as S. Y. it must, of course, be a very easy matter. The problems that are met with in practice, and of equal seeming simplicity to this, are full of difficulties in the way of mathematical

investigation; for they in reality involve more complicated actions than any which the celestial motions afford. But I am relapsing into my usual discursive habit, and that, too, on a most unworthy occasion.

I am, Sir, yours, &c.,

BENJAMIN CHEVERTON.

P. S.—"S. Y." finds fault with Professor Moseley's machine. It is very strange, that he, being an *operative*, and not particularly *a civil* "engineer," should not know that practical mechanics present many expedients to obviate the objection he refers to; but a carping disposition is fatuously blind.

## CALCULATING MACHINES.

Sir,—In your Magazine for last month I observe a notice of a calculating machine, invented by Dr. Roth, of Paris. As much as twenty-five years ago, a similar machine, (for the purpose of facilitating the operations of the four first rules of arithmetic,) had occupied my attention, and I had succeeded in contriving one, to perform calculations in addition and multiplication, with a round dial, similar to the dial of a watch, with four hands or pointers, to point to a corresponding number of circles, representing pounds, shillings, and pence, and the fractional parts of a penny; and since then I have again thought over my original design, and am happy to say have been successful in contriving a machine capable of performing, mechanically, the first four rules of arithmetic, viz., addition, subtraction, multiplication, and division, the whole complete in one machine, enclosed in a box six inches square by two inches deep.

Dr. Roth's system, it will be remembered, requires two separate machines, one square, for addition and subtraction, the other circular, for multiplication and division. But I effect all these purposes by a single machine, one part performing the operations of addition and multiplication, and another the operations of subtraction and division, each connected by clockwork to the same system of levers that give motion to the other. Dr. R. shows the result of his operation through a number of circular openings; mine in a long opening in the face of the machine, thus, | 6 3 4 2 8 9 0 7 2 1. | Again, no other figures being visible but those produced in the operation, the chief point of difference known is the price. One of Dr. Roth's machines costs 2*l.* 2*s.*, and the other 26*l.* 5*s.*, together 28*l.* 7*s.*; while mine may be afforded, (made in a good workmanlike manner, leaving a fair amount of profit,) for about a twentieth part of the above price, viz., 30*s.* I think this is conclusive evidence that mine must be either a totally different machine, or the other most extravagantly overcharged.

I remain, Sir, yours respectfully,

A COUNTRY CLOCKMAKER.

Mount Pleasant,
20th November, 1841.

## NOTICES OF RECENT AMERICAN PATENTS.

[Selected and abridged from the *Franklin Journal.*]

ELECTRO MAGNETIC MACHINE, *Truman Cook.* The following extract from the specification will give a pretty accurate idea of the invention. "Having thus fully described the manner in which I construct my electro-magnet apparatus, and likewise the manner of making the improved galvanic trough for actuating the same, what I claim therein as constituting my invention, and desire to secure by letters patent, is first, the arranging of the armatures upon a cylinder, or drum, in combination with the pairs of electro-magnets so situated as that the negative and positive pole of each individual magnet shall, at the same moment, be over two contiguous armatures, in the manner herein set forth." "Secondly, I claim the mode of interrupting the galvanic circuit by means of the cams, or notches, on the axis of the cylinder operating the wires which dip into the cups of mercury, as set forth, in combination with the stationary magnets and revolving armatures, arranged and constructed as herein described." "Lastly, I claim the galvanic battery herein described, composed of separate and distinct plates, communicating with cups of mercury, in the manner described, in combination with the electro-magnetic apparatus, consisting of stationary magnets and revolving armatures, as described."

"At the period," says Dr. Jones, "when this patent was obtained, a machine of considerable size had been built, for the purpose of driving the propelling apparatus of a boat; not having heard of the result of the experiment, we are compelled to infer that there is one more to be added to the list of unsuccessful attempts in the employment of the electro-magnetic power as a substitute for steam."

## LIST OF DESIGNS REGISTERED BETWEEN NOVEMBER 26TH, AND DECEMBER 21ST, 1841.

| Date of Registration. 1841. | | Number on the Register. | Registered Proprietors' Names. | Subject of Design. | Time for which protection is granted. |
|---|---|---|---|---|---|
| Nov. | 26 | 936 | Samuel Alfred Carpenter ... | Strap fastener | 3 years. |
| | " | 937,39 | H. and J. Dixon | Kidderminster Carpet | 1 |
| | 29 | 940,1 | George Ratcliff | Fender | 3 |
| | " | 942 | William Strafford Taft | Whip | 3 |
| | " | 943,47 | G. and H. Talbot and Sons | Kidderminster Carpet | 1 |
| | 30 | 948 | Henry Wilson | Metal plate | 3 |
| | " | 949 | Sampson Mordan | A steel pen corrector | 3 |
| | " | 950 | William Morgan | Gas burner | 3 |
| | " | 951 | Ditto | Chimney gas burner | 1 |
| Dec. | 1 | 952 | Joseph Schlesinger and Co. | Pneumatic calendar | 3 |
| | " | 953 | Ditto | Paper or letter clip | 3 |
| | " | 954 | Samuel Ackroyd | Fender | 3 |
| | " | 955 | John Richard Philp | Fastening for clogs | 3 |
| | 2 | 956 | James Heeley and Sons | Buckle | 3 |
| | 3 | 957 | Robert Broadbent | Chaff cutter | 3 |
| | " | 958,63 | Williams, Cooper, and Co. | Stained Paper | 1 |
| | 6 | 964 | Stoddart and Boycott | Kidderminster carpet | 1 |
| | 7 | 965 | Thomas Taylor | Bit | 3 |
| | 8 | 966 | Joseph Fenn | Revolving oil stone | 3 |
| | 9 | 967 | John Sheldon | Pencil case containing pen, tooth-pick, and letter balance | 3 |
| | " | 968 | William Wilson Paget | Articulated scissors | 3 |
| | 10 | 969 | Simon King | Calorific smoke conductor | 3 |
| | " | 970 | Williams, Cooper, and Co. | Stained paper | 1 |
| | " | 971 | Ormond A. Wyatt | Luggage label | 3 |
| | " | 972 | Joseph Fenn | Coach wrench | 3 |
| | 13 | 973 | John Tresahar Jeffree | Port lift | 3 |
| | 15 | 974 | Henry Knight | Clock case | 3 |
| | " | 975 | James and Edward Plenty | Thrashing machine | 3 |
| | 16 | 976 | — Thompson | Fire-escape belt | 3 |
| | " | 977 | Joseph Fenn | Coach wrench | 3 |
| | 17 | 978 | Edmund Heeley and Co. | Letter clip | 3 |
| | " | 979 | Samuel Nicholls | Pen holder | 3 |
| | " | 980 | Elisha E. Blaney | Frame work and air cushion for billard table | 1 |
| | 20 | 981 | Henry Wood | Mincing machine | 3 |
| | " | 982 | Joseph Newcomb, Son, and Jones | Carpet | 1 |
| | 21 | 683 | Benjamin Walton and Co. | Vase | 3 |
| | " | 984 | William Aston | Button | 3 |

## LIST OF ENGLISH PATENTS GRANTED BETWEEN THE 25TH OF NOVEMBER, AND THE 21ST OF DECEMBER, 1841.

Robert Wilson, of Sowerby Bridge, Halifax, currier and tanner, for improvements in the manufacture of leather. Dec. 2; six months.

William Irving, of Princes-street, Rotherhithe, gentleman, for improvements in the manufacture of bricks and tiles. Dec. 7; six months.

James Colman, of Stoke Holy Cross, Norfolk, starch manufacturer, for improvements in the manufacture of starch. Dec. 9; six months.

William Henry Fox Talbot, of Lacock Abbey, Wilts, Esq., for improvements in coating or covering metals with other metals, and in colouring metallic surfaces. Dec. 9; six months.

John Hall, of Breezes Hill, Ratcliff Highway, sugar refiner, for improvements in the construction of boilers for generating steam, and in the application of steam to mechanical power. December 9; six months.

Archibald Templeton, of Lancaster, silk spinner, for a new or improved method of preparing for spinning silk and other fibrous substances. Dec. 9; six months.

Jonathan Guy Dashwood, of Ryde, Isle of Wight, plumber, for improvements in the construction of cocks and taps. Dec. 9; six months.

Moses Poole, of Lincoln's Inn, gentleman, for improvements in the construction of masts for ships and vessels, and in applying the shrouds. Dec. 9; six months. (Being a communication.)

Josiah Taylor, of Birmingham, brass founder, for improvements in the construction of lamps. December 9; six months.

Robert Henderson, of Birmingham, china dealer and glass stainer, for certain improvements in apparatus for heating and lighting apartments, and for other like purposes. Dec. 9; six months.

Henry Wilkinson, of Pall Mall, gun-maker, for improvements in machinery to be used in constructing buildings, and in raising and lowering weights and materials. December 9; six months. (Being a communication.)

John Edwards, of Shoreditch, warehouseman, for improvements in giving signals on railways. December 11; six months.

William George Henry Taunton, of Liverpool, engineer, for improvements in machinery for raising weights. Dec. 11; six months.

William Westley Richards, of Birmingham, gunmaker, for improvements in the construction of

gun and pistol locks and primers for the discharge of fire arms. Dec. 14; six months.

William Edward Newton, of Chancery Lane, civil engineer, for certain improvements in printing and delineating patterns, and printed cloths for floor cloths, covers, and other uses. December 14; six months. (Being a communication.)

Francis Mar, of 81, Eaton Square, Esq., for certain improvements in the construction of ships or other vessels, and the method of propelling them. December 16; six months. (Being a communication.)

William Neilson, builder, David Lyon, builder, and Peter McOnie, engineer, all of Glasgow, for a mode, or modes of, or an improvement, or improvements in cutting, dressing, preparing, and polishing stones, marble, and other substances, and also in forming flat or rounded mouldings, and other figures thereon. Dec. 16; six months.

Charles Edward Austin, of Fulham, engineer, for an apparatus for what is commonly called "changing the line," on railways. December 16; six months.

James Stewart, of Osnaburgh-street, Regent's-park, pianoforte maker, for an improvement in the construction of castors. December 16; six months.

William Prowett, of Northamptonshire, victualler, for improvements in giving signals on railways. December 16; six months.

Henry Booth, of Liverpool, esquire, for improvements in the method of propelling vessels through water. December 16; six months.

John Norton, of the Junior United Service Club, Regent-street, esquire, for improvements in sheathing ships and other vessels. December 16; six months.

Antoine Mertens, of the London Coffee-house, publisher, for improvements in the manufacture of plaited fabrics. December 16; six months.

William Church, of Birmingham, civil engineer, and Jonathan Harlow, of the same place, manufacturer, for certain improvements in the mode of manufacturing metallic tubes, and in the mode of joining them, or other tubes or pieces, for various useful purposes. December 16; six months.

Thomas Starkey, of Birmingham, copper cap manufacturer, for improvements in percussion caps for discharging fire-arms. December 16; six months.

John Americus Fanshawe, of Hatfield-street, Christ Church, gentleman, for an improved manufacture of waterproof fabric, applicable to the purposes of covering and packing bodies, buildings, and goods, exposed to water and damp. December 16; six months.

William Buckwell, of Trinity-street, Borough, civil engineer, for improvements in scaffolding or frame-work for building purposes. December 16; six months.

Charles Loosey, of Half-moon-street, Piccadilly, civil engineer, for improvements in steam-engines, and which improvements are also applicable in raising or forcing water and propelling vessels. December 16; six months.

John Bould, of Overden, Halifax, cotton spinner, for an improvement or improvements in condensing steam-engines. December 16; six months.

Antoine Jean Francois Claudet, of High Holborn, glass merchant, for certain improvements in the process or means of and apparatus for obtaining images or representations of nature or art. December 18; six months.

Henry Hough Watson, of Bolton-le-Moors, Lancaster, consulting chemist, for certain improvements in dressing, stiffening, and finishing cotton and other fibrous substances, and textile and other fabrics, part or parts of which improvements are applicable to the manufacture of paper, and also to some of the processes or operations connected with printed calicoes and other goods. December 21; six months.

William Edward Newton, of Chancery-lane, civil engineer, for certain improvements in lamps and burners, and in the means of supplying air and heat thereto for the support of combustion. (Being a communication.) December 21; six months.

William Newton, of Chancery-lane, civil engineer, for certain improvements in cleansing wool and facilitating the operation of dyeing, and also in washing and bleaching cotton yarns or fabrics. (Being a communication.) December 21; six months.

Ovid Topham, of Whitecross-street, engineer, for improvements in engines, machines, apparatus, or means for extinguishing, stopping the progress of fire in any room or part of different buildings which may have become ignited, such as noblemen or gentlemen's mansions, houses, factories, store, and warehouses, and consequently preserving them from destruction, and preventing the loss of life. December 21; six months.

George Palmer Henry, of Peckham, chemist, for improvements in apparatus to be applied to glass chimneys of gas burners. December 21; six months.

John Cox, of Gougie Mills, Edinburgh, tanner and glue maker, for certain improved processes of tanning. December 21; six months.

John Oliver York, of Upper Coleshill-street, Eaton-square, engineer, for improvements in the construction of railway axles and wheels. December 21; six months.

William Carron, of Birmingham, lathe-maker, for improvements in the construction of clogs and pattens. December 21; six months.

William Henry Smith, of Finsbury Chambers, civil engineer, for certain improvements in the construction and manufacture of connectors or fastenings applicable to garments and other uses. December 21; six months.

Adolphe Fourment, of Museum-street, engineer, for improvements in castors for cabinet furniture and other purposes. December 21; six months.

Thomas Wright, of Church-lane, Chelsea, lieutenant in the royal navy, and Alexander Bain, of Percival-street, Clerkenwell, mechanist, for improvements in applying electricity to control railway engines and carriages, to mark time, to give signals, and print intelligence at distant places. December 21; six months.

Henry Alphonse Bonneviale Bonveiron, of Trevor-square, merchant, for improvements in axletrees. Dec. 21; six months. (Being a communication.)

William Binge, of Bristol, sign painter, for improvements in propelling vessels. Dec. 21; six months.

William Carr Thornton, of Cleckheaton, machine maker, for certain improvements in machinery or apparatus for making cards for carding cotton and other fibrous substances. Dec. 21; six months.

## END OF THE THIRTY-FIFTH VOLUME.

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